

**BEAVER CREEK
MOUNTAIN IMPROVEMENTS PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT
May 2012**



**USDA Forest Service
White River National Forest
Eagle/Holy Cross Ranger District**

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call (800) 795-3272 or (202) 720-6382 (TDD).

USDA is an equal opportunity provider and employer.

ABSTRACT

FINAL ENVIRONMENTAL IMPACT STATEMENT

FOR THE

BEAVER CREEK MOUNTAIN IMPROVEMENTS PROJECT

**WHITE RIVER NATIONAL FOREST
EAGLE COUNTY, COLORADO**

MAY 2012

Lead Agency:	USDA Forest Service
Responsible Official:	Scott Fitzwilliams, Forest Supervisor White River National Forest
For Information Contact:	Don Dressler Eagle/Holy Cross Ranger District PO Box 190 Minturn, Colorado 81645 (970) 827-5157

Abstract: This Final Environmental Impact Statement (FEIS) has been prepared to analyze and disclose the estimated environmental effects of implementation of the Beaver Creek Mountain Improvements Project. Beaver Creek Resort is located on the White River National Forest in Eagle County, CO and operates in accordance with the terms and conditions of a Special Use Permit, which is administered by the United States Forest Service. The Proposed Action includes the following components: terrain improvements along the existing men's *Birds of Prey* racecourse; strategic trail construction, widening and grading to accommodate the addition of women's Downhill and Giant Slalom racecourses; new and replaced snowmaking infrastructure; regrading and infrastructure improvements at Red Tail Camp; and replacement of the Red Tail Camp restaurant.

This Final EIS discusses the purpose and need for the Proposed Action; alternatives to the Proposed Action; potential direct, indirect, and cumulative impacts of implementing each alternative; and project design criteria. Two alternatives are analyzed in detail in this FEIS—the No Action (required) and the Proposed Action.

Appeals: The decision documented in the ROD is subject to appeal pursuant to 36 CFR 215.11. Any appeal of this decision must be fully consistent with 36 CFR 215.14, "Content of Notice of Appeal," and it must be received within 45 days of the date of publication of the legal notice in the *Glenwood Post*.

Executive Summary

EXECUTIVE SUMMARY

A. INTRODUCTION

The proposed projects analyzed in this environmental impact statement (EIS) constitute a federal action (i.e., a decision), with potential to affect the quality of the human environment on National Forest System (NFS) lands. Therefore, these projects must be analyzed pursuant to the National Environmental Policy Act (NEPA) which directs federal agencies to carefully consider environmental concerns in the decision making process and provide relevant information to the public for review and comment.

The Forest Service has prepared this Final Environmental Impact Statement (FEIS) in compliance with NEPA and other relevant Federal and State laws and regulations. This FEIS discloses potential direct, indirect, and cumulative environmental effects on the human and biological environment estimated to result with implementation of the Proposed Action.

B. SUMMARY OF THE PURPOSE AND NEED FOR THE PROPOSED ACTION

- Need #1 – Improve upon/expand terrain to meet International Ski Federation (FIS) requirements for both men's and women's Alpine race events.
- Need #2 – Provide a racecourse finish area that meets FIS requirements for larger Alpine race events.
- Need #3 – Improve on-mountain guest services to accommodate the general public throughout the year and during Alpine race events.
- Need #4 – Respond to key infrastructural deficiencies related to race storage, water delivery and wastewater.

C. SUMMARY OF THE ALTERNATIVES ANALYZED IN THE DEIS

ALTERNATIVE 1 – NO ACTION

By definition, the No Action Alternative represents a continuation of existing management practices without changes, additions, or upgrades to existing conditions.

Under the No Action Alternative, Beaver Creek Resort (Beaver Creek) would continue to host the only men's World Cup event in the United States. Due to a lack of suitable terrain to host the women's Downhill, Giant Slalom or Super G, it would not be possible for Beaver Creek to host these women's events.

ALTERNATIVE 2 – THE PROPOSED ACTION

The Proposed Action is consistent with Beaver Creek’s 2010 Master Development Plan (MDP) Update. Specific projects included in Alternative 2 – the Proposed Action were designed to meet the four elements of the Purpose and Need (listed above and detailed in Chapter 1). Refer to Figure 2, the Alternative 2 Proposed Action figure for the proposed projects.

Race Terrain

- Construct a women’s Downhill course in the Birds of Prey pod, which necessitates widening *Flattops* and *Peregrine*, construction of two new trail segments.¹
- Construct a women’s Giant Slalom course on Grouse Mountain, which necessitates widening existing trails, construction of a new connector trail between *Raven Ridge* and lower *Golden Eagle*.
- Improve the existing *Birds of Prey* men’s Downhill course, necessitating trail widening just above *Westfall Road* and strategic re-grading along the racecourse to reduce the need for snowmaking.
- Construct a new access trail between *Goshawk*, *Peregrine* and *Golden Eagle* that would enable event spectators to reach the middle portion of the men’s *Birds of Prey* racecourse and women’s Downhill course.
- Widen an existing utility corridor between *Red Tail* trail and the *Dally* catwalk to improve skier/rider circulation when descending to Red Tail Camp from the top of the Centennial Express.
- Snowmaking infrastructure installation on the two new trail segments and snowmaking infrastructure upgrading on *Raven Ridge* (requires additional hydrants).

Racecourse Finish Area

- Re-grade the entire Red Tail Camp race finish area.
- Replace and realign the culverted portion of Westfall Creek that runs through the Red Tail Camp area and culvert an approximate 150-foot stretch of Westfall Creek.
- Relocate existing utility lines throughout the Red Tail Camp area.
- Relocate and expand the TV compound to accommodate current and future media needs as well as spectators access related to Alpine racing events.

¹ “Pod” is defined as a lift and the terrain in which it is generally associated (i.e., some terrain can be accessed by multiple lifts).

Guest Services

- Relocate and replace Red Tail Camp with a larger building (increasing the capacity to roughly 600 indoor and 160 outdoor seats).

Infrastructure Projects

- Install a 24 x 36-foot storage facility west of the top terminal of the Birds of Prey Express.
- Construct a new 150,000-gallon water tank and pump station on the edge of *Paint Brush*, adjacent the *Beaver Creek Expressway*.
- Install a new water line from the proposed 150,000-gallon water tank to the Beano's Cabin water line.
- Upgrade the existing 4-inch domestic water line from Beano's Cabin to Red Tail Camp to an 8-inch water line.
- Install approximately 3,000 feet of new sewer line from Red Tail Camp down *Dally* (extending north onto private land).

Table ES-1 summarizes the components of Alternatives 1 and 2.

**Table ES-1:
Summary Comparison of Alternatives**

	Alternative 1 No Action	Alternative 2 Proposed Action
GUEST CAPACITIES		
Comfortable Carrying Capacity	15,320	15,320
Manage-To Threshold	13,000	13,000
SUP Area	3,849 acres	3,849 acres
TRAILS		
Number of Trails	148	148
LIFTS		
Number of Lifts	23	23
PARKING		
Total Parking Lots	13	13
Total Day Skier Vehicle Capacity	2,836 vehicles ^a	2,836 vehicles ^a
SUMMER RECREATION		
Trail System Mileage	37.6	37.6
ON-MOUNTAIN GUEST SERVICES		
Total Seating (both indoor and outdoor)	3,187	3,472
SNOWMAKING COVERAGE		
Within the Beaver Creek Watershed	179 acres	217 acres

**Table ES-1:
Summary Comparison of Alternatives**

	Alternative 1 No Action	Alternative 2 Proposed Action
ALPINE RACE TERRAIN		
Men's FIS Downhill Racecourse	Yes	Yes (improved)
Men's FIS Super G Racecourse	Yes	Yes
Men's FIS Giant Slalom Racecourse	Yes	Yes
Women's FIS Downhill Racecourse	No	Yes
Women's FIS Super G Racecourse	No	Yes
Women's FIS Giant Slalom Racecourse	No	Yes
Racecourse Spectator Access	<i>Birds of Prey</i> racecourse can be viewed by descending <i>Peregrine</i> to pumphouse on skiers' right of <i>Golden Eagle</i>	Men's and Women's <i>Birds of Prey</i> Downhill racecourses could be accessed via a new access route constructed between <i>Goshawk</i> and <i>Peregrine</i>
ALPINE RACE INFRASTRUCTURE		
Red Tail Finish Stadium Spectator Capacity	~4,000 spectators	~10,000 to ~12,000
On-Mountain Equipment Storage	Temporary	Permanent, 864 square feet
Television Compound	~13,500 square feet	~23,500 square feet
UTILITIES		
Water Storage for Red Tail Camp area	1 tank: 156,000 gallons	2 tanks: 156,000 gallons and 150,000 gallons
Daily sewer line	At/near capacity	Additional capacity

^a Historically, Beaver Creek has worked with appropriate entities such as the state police and area landowners to accommodate event parking.

D. PUBLIC INVOLVEMENT

On December 3, 2010 a scoping package was mailed to approximately 35 community residents, interested individuals, public agencies, and other organizations. The scoping package provided a brief description of the Proposed Action, the Purpose and Need for Action, and an illustrative map. This information was specifically designed to elicit comments, concerns, and issues pertaining to the Proposed Action. A legal notice was published in the Glenwood Post Independent, and a Notice of Intent (NOI) to prepare an EIS was published in the Federal Register, on December 14, 2010. A public open house was held on January 6, 2011, at the Avon Public Library. In addition, the scoping package was posted on the WRNF website.

Based on the 41 letters received during scoping, a comment disposition was completed, which documents the Forest Service ID Team's categorization of each substantive comment. The comment disposition was prepared to identify issues and the formulation of potential alternatives to the Proposed Action. The issues are specifically addressed in Chapter 3 – Affected Environment and Environmental Consequences, of the Draft and Final EIS.

The Draft EIS was released for a 45-day comment period on November 25, 2011. The Forest Service received 29 letters during the comment period—24 in support, 2 in opposition, 1 neutral and 2 from federal agencies (Environmental Protection Agency and US Fish and Wildlife Service). Substantive comments provided on the Draft EIS are formally responded to in the Response to Comments.

E. SUMMARY OF RESOURCE ISSUES ADDRESSED

Based on the results of scoping, the Forest Service identified specific areas of public concern. Each of the following issue statements includes a list of indicators which were identified as a means of measuring or quantifying the anticipated level of impact on a particular resource. Table ES-2 summarizes environmental consequences, by issue and indicator, associated with Alternative 1 and Alternative 2. Detailed accounts of environmental consequences, by resource, are contained in Chapter 3.

**Table ES-2:
Summary of Environmental Consequences**

Alternative 1	Alternative 2
RECREATION	
Issue: Proposed projects within the Birds of Prey and Grouse Mountain pods would alter Beaver Creek's ability to accommodate public skiing and to host Alpine race events.	
<i>Indicator: Qualitative discussion of Beaver Creek's ability to host FIS-sanctioned race events under all alternatives.</i>	
Under Alternative 1, Beaver Creek would continue to host the only men's World Cup Alpine event in the United States; however, Alternative 1 would not address Beaver Creek's existing lack of a racecourse that meets FIS requirements for hosting women's Downhill or Giant Slalom events. Therefore, it would not be possible for Beaver Creek to host the 2015 World Alpine Ski Championships under Alternative 1.	Under Alternative 2, terrain improvements/additions (e.g., grading, widening, new trail segments, and snowmaking) would enable Beaver Creek to meet FIS requirements for both men's and women's Alpine race events. The proposed projects would not only enable Beaver Creek to improve the men's <i>Birds of Prey</i> racecourse, but it would be able to host women's Downhill and Giant Slalom events, thus enabling it to host larger international Alpine racing events, including the 2015 World Alpine Ski Championships.
<i>Indicator: Quantitative and qualitative analysis of existing and proposed guest service facilities and infrastructure.</i>	
Under Alternative 1, no changes or modifications would occur to Beaver Creek's on-mountain guest service facilities. In particular, and as identified in Beaver Creek's 2010 MDP, Red Tail Camp would remain undersized for the use it experiences on a typical weekend day.	Under Alternative 2, Red Tail Camp would be relocated and replaced with a new building, accommodating approximately 600 indoor seats (500 indoor cafeteria seats and 100 indoor table service seats), and roughly 160 outdoor seats.
Issue: Construction work on these courses and the Red Tail expansion may limit access for hiking, biking and skiing for two years.	
<i>Indicator: Duration and extent of terrain closures on Grouse Mountain and Birds of Prey that would affect public skiing and summer recreational trail use.</i>	
Summer recreation would be unaffected under Alternative 1. Public ski access would be unaffected under Alternative 1 as the annual World Cup races occur early in the ski season prior to this terrain opening to the public.	For safety and security reasons, the men's and women's racecourses themselves would be closed to the public prior to, during, and immediately following the 2015 World Alpine Ski Championships under Alternative 2. It is anticipated that the individual trails that make up the separate racecourses would be closed for approximately one month prior to the event and two weeks after the event for snow surface preparation, safety fencing, and television broadcast set up and tear down. During this time, access to ski terrain by resort guests in the project area would be restricted. Alternative 2 would require the temporary closure or reroute of two summer trails during racecourse construction, expected to occur over two seasons. However, this would represent a temporary inconvenience and it is anticipated that recreational users would utilize other trails offered at Beaver Creek during this time.

**Table ES-2:
Summary of Environmental Consequences**

Alternative 1	Alternative 2
TRAFFIC, PARKING, AND SKI AREA ACCESS	
Issue: The Proposed Action may have effects on traffic on I-70 and through the Town of Avon, as well as day skier parking.	
<i>Indicator: Quantification of existing and projected traffic on I-70 related to Beaver Creek's winter operations, including the annual Birds of Prey World Cup event.</i>	
As displayed in Table 3B-3, Beaver Creek's operations between November and April of each year contribute, on average, approximately 704 round trips per day on I-70. Beaver Creek's annual Birds of Prey World Cup event contribute, on average, approximately 838 round trips per day on I-70 (see Table 3B-4).	While it is not possible to predict attendance or related traffic for the 2015 World Alpine Ski Championships with precision, under Alternative 2, average daily traffic related to the 13-day event has been estimated at between 800 and 900 vehicle roundtrips. Peak daily traffic contributions (most likely at the beginning and end of the event) would be higher.
<i>Indicator: Quantification of parking capacities for day skiers, media and spectators.</i>	
Under Alternative 1, Beaver Creek has existing parking capacity to accommodate approximately 2,836 vehicles on 13 parking lots (see Table 3B-5). Beaver Creek has also historically parked an additional 950 vehicles during peak use days through a combination of CDOT permit parking on Highway 6 and the Rodeo Grounds in Avon. Demand for, and supply of, resort parking throughout the year (including the <i>Birds of Prey</i> World Cup events) would not change under the No Action Alternative.	Parking for future Alpine racing events, including the 2015 World Alpine Ski Championships, would be as described under Alternative 1.
<i>Indicator: Qualitative analysis of existing and proposed race event access.</i>	
A combination of shuttle busses and on-mountain skier access routes accommodates spectators for World Cup events.	Same as Alternative 1.
SCENERY	
Issue: Proposed projects may be visible from identified critical viewpoints.	
<i>Discussion of the Scenic Integrity Objectives (SIO) for the project area, as defined by the 2002 White River National Forest Land and Resource Management Plan.</i>	
Under Alternative 1, Beaver Creek's existing lift and trail network, all related infrastructure, maintenance and guest operation buildings are currently consistent with the 2002 Forest Plan SIO designations (<i>Very Low</i> and <i>Low</i>) for the SUP, as well as forest-wide guidelines for scenery management.	Implementation of the project elements contained in the Proposed Action would not affect Beaver Creek's compliance with the SIO of <i>Very Low</i> . PDFs and BMPs for visual resources would be applied, where appropriate, to minimize associated impacts to visual resources
<i>Documentation of the incremental effects to the scenic environment resulting from implementation of the proposed projects compared to historic landscape alterations within the SUP area.</i>	
Ski trails and lifts at Beaver Creek have traditionally created large open areas through forest lands and can be seen with respect to the present ski trails and lifts from I-70 at Beaver Creek. Under Alternative 1, the scenic environment would not change from the existing condition.	Implementation of Alternative 2 would result in minor, incremental landscape alterations throughout the developed lift and trail network, however due to the scope of the project it is unlikely that non-recreational viewers would notice a change from the existing condition.

**Table ES-2:
Summary of Environmental Consequences**

Alternative 1	Alternative 2
<i>Discussion of the Forest Service's Built Environment Image Guide (BEIG) as applicable to existing and proposed guest service facilities.</i>	
The architectural character of the project area under Alternative 1 would continue to comply with the BEIG within the Rocky Mountain Province.	The Beaver Creek SUP area and adjacent NFS lands are within the Rocky Mountain Province. Site development, sustainability, and architectural character of Red Tail Camp under Alternative 2 would conform to BEIG guidelines described for this Province.
<i>Viewshed analysis, from identified critical viewpoints, of proposed landscape alterations as compared to the existing condition.</i>	
The lift and trail network on north and west facing aspects of the Upper Mountain (Cinch Express/Birds of Prey Express pods and Grouse Mountain) can only be perceived in the middleground/background distance zones to eastbound travelers on I-70. For westbound travelers, the view of Beaver Creek is limited. The lower portion of the existing trails that make up the men's Downhill course are not visible from I-70.	To the casual observer traveling on I-70 (middleground/background viewpoints), the proposed racecourse projects within the Birds of Prey Express and Grouse Mountain Express lift/terrain pods would be indistinguishable from the existing trails under Alternative 2. It is reasonable to assume that anyone viewing the project area from the foreground view (i.e., within the ski area) would expect to see lifts, trails and infrastructure.
SOCIAL AND ECONOMIC RESOURCES	
Issue: Alpine ski race events hosted at Beaver Creek under each alternative may impact social and economic resources in the project area.	
<i>Indicator: Analysis of historic and projected visitor spending (at the local and state levels) resulting from hosting annual World Cup events and the World Alpine Skiing Championships.</i>	
Selection of the No Action Alternative would not affect Beaver Creek's ability to host the annual Birds of Prey men's World Cup event, and the economic benefits of the three-day event. Therefore, under Alternative 1 direct economic impact would continue to be approximately \$1.8 to \$2.0 million per year (as in the existing condition).	Based on the economic impact to the local economy during the 1999 World Alpine Ski Championships, it is conservatively estimated that the State of Colorado economic impact under Alternative 2 would be approximately \$100 million, with 75 percent being specific to Eagle County.
<i>Indicator: Projected long-term/short-term and direct/indirect employment under all alternatives.</i>	
Although Beaver Creek is one of the major employment contributors in Eagle County, the majority of the annual <i>Birds of Prey</i> World Cup race activities are performed by volunteers, therefore little-to-no direct or indirect employment at Beaver Creek results from hosting the event (as in the existing condition). Current employees of Beaver Creek may receive some overtime pay as result of preparing for the event.	Due to the large number of volunteers which would be utilized for the event, direct, seasonal employment at Beaver Creek under Alternative 2 is not anticipated to measurably increase at the county scale as a result of the proposed improvements or by hosting the two week event. Indirect seasonal employment (e.g., restaurants, hotels etc.) within the local economy is likely to increase as businesses increase short-term employment and current employee's hours in order to accommodate the anticipated 39,100 total attendees (or 120,000 visits by attendees over the 13 days of racing) during the event.

**Table ES-2:
Summary of Environmental Consequences**

Alternative 1	Alternative 2
AIR QUALITY	
Issue: Short-term, construction related activity, as well as potential increases in vehicular traffic related to spectator events at Beaver Creek could negatively impact air quality in the region.	
<i>Indicator: Estimation of existing and predicted emissions associated with Beaver Creek's operations and spectator events</i>	
It is anticipated that Eagle County would continue to be classified as an attainment area for all monitored criteria pollutants and no additional air quality issues would be anticipated due to existing regulations, climate and topography. No air quality impacts are expected at Beaver Creek or adjacent NFS or Eagle County lands from the continuation of hosting annual Birds of Prey World Cup events at Beaver Creek.	Same as Alternative 1. Hosting the 2015 World Alpine Ski Championships at Beaver Creek would not contribute any discernable impacts to air quality in the project area. Although there would be localized short-term air quality effects due to the burning of wood debris during trail construction, the effects are anticipated to be greatly reduced due to the efficient burn method used for disposal and would cease once the debris has been completely incinerated.
<i>Indicator: Discussion/quantification of estimated greenhouse gas emissions associated with spectator events at Beaver Creek under all alternatives.</i>	
Under Alternative 1, short-term spectator related GHG emissions during the annual Birds of Prey World Cup event would continue to contribute approximately 414.5 metric tons of CO ₂ e during the 3-day event.	Under Alternative 2, short-term spectator related GHG emissions related to the 2015 World Alpine Ski Championships would contribute an estimated 2,690.7 metric tons of CO ₂ e during the 13-day event.
<i>Indicator: Compliance with local, state and federal regulations regarding air quality.</i>	
No adverse impacts. No operational emissions would exceed ambient air quality standards. Predicted increases in CO ₂ and toxic air pollutants due to increased traffic would remain below local, state and federal regulations regarding air quality.	No adverse impacts. No operational emissions would exceed ambient air quality standards. Predicted increases in CO ₂ and toxic air pollutants due to increased vehicular traffic related to attendees accessing race events would remain below local, state and federal regulations regarding air quality.
CULTURAL RESOURCES	
Issue: Proposed projects and associated ground disturbing activities may affect known or unidentified cultural resources.	
<i>Indicator: Discussion of cultural surveys completed to date in the vicinity of the project area.</i>	
The files of the Colorado Office of Archaeology and Historic Preservation (OAHP) Compass database and the WRNF were consulted prior to the initiation of fieldwork. Four sites are located close to proposed development areas; one additional site that was originally thought to be near the proposed development area was re-plotted based on the UTM's provided on the site form and the location was discovered to be more than 400 feet north of the project area.	All inventory reports were submitted to the SHPO in completion of the NHPA Section 106 process. SHPO concurrence regarding this project was received on November 28, 2011.

**Table ES-2:
Summary of Environmental Consequences**

Alternative 1	Alternative 2
<i>Indicator: Inventory project area for cultural resources and historic properties.</i>	
The other two sites identified during the file search appeared to be separate sites from the reports, but in the field they were identified as a prehistoric lithic scatter and log cabin associated with old Beano's cabin. The historic cabin has mostly been reconstructed since the last recording in 2002 (at that time it was recommended as not eligible to the NRHP) and no signs of the associated prehistoric lithic scatter were found. The archeologists did not find any evidence of possible buried cultural deposits as there was no evidence of intact soils and road base surrounds the cabin. Due to the current condition of the area, the archeologist recommended that neither the old Beano's cabin, nor the adjacent lithic scatter, is eligible for the National Register and no further work is recommended.	Implementation of the Alternative 2 was determined to have "no effect" on any known NRHP listed or eligible historic properties. Written concurrence regarding this project was received on November 28, 2011.
WILDLIFE & AQUATIC SPECIES	
Issue: Implementation of proposed projects (including construction and use) could affect Threatened, Endangered and Sensitive (TES) and Management Indicator (MIS) wildlife and aquatic species.	
<i>Indicator: Identification and analysis of alternatives on threatened and endangered aquatic species and habitat present in the project area. Consultation may be required for effects of water depletion on big river endangered fish as a result of new snowmaking.</i>	
None of the four listed, endangered fish (pertinent Colorado pikeminnow, bonytail, humpback chub, and razorback sucker) occur any closer to the project area than the main stem of the Colorado River near Rifle. Under Alternative 1, no new snowmaking or water depletion would occur.	None of the four listed, endangered fish (pertinent Colorado pikeminnow, bonytail, humpback chub, and razorback sucker) occur any closer to the project area than the main stem of the Colorado River near Rifle. Under Alternative 2, the additional 35.3 AF of water depletions downstream in the Colorado River as a result of new snowmaking warrants a "may affect, likely to adversely affect" determination.
<i>Indicator: Identification and analysis of alternatives of Region 2 sensitive aquatic (fish and amphibian) species and habitat present in the project area.</i>	
Three R2 sensitive aquatic species are present or potentially present within the project area: Colorado River cutthroat trout, boreal western toad, and northern leopard frog. Under Alternative 1 no change from the current conditions of species and habitat are expected.	Three R2 sensitive aquatic species are present or potentially present within the project area: Colorado River cutthroat trout, boreal western toad, and northern leopard frog. Direct, indirect, and reasonably foreseeable project effects of Alternative 2 would have no impact on these species.

**Table ES-2:
Summary of Environmental Consequences**

Alternative 1	Alternative 2
<i>Indicator: Analysis of physical stream health in the project area and the effects on aquatic life.</i>	
Under Alternative 1, physical stream health is not expected to change.	Alternative 2 would cause short-term, localized, ground disturbing activities (creek culverting and stream restoration, disturbances within the WIZ, tree removal, grading of some trails, snowmaking line installation, building installation, etc.) and increased runoff (short- to long-term from additional snowmaking and tree removal) with the potential to increase erosion, sedimentation, and local slope failures that could extend to local creeks and cause changes to the hydrology, aquatic habitat, and macroinvertebrate communities within project area streams. Virtually all disturbances would occur within the Westfall Creek drainage, a first-order, high gradient, tributary of Beaver Creek located within the developed interior of Beaver Creek. Alternative 2 would add to the collective changes in channel conditions that have occurred since the initial development of Beaver Creek. However, with the implementation of Best Management Practices and water quality-related PDF (Table 2-1) that would be implemented to avoid, minimize, and mitigate adverse effects to aquatic habitat within and below the project area additional degradation would be minimized.
<i>Indicator: Assessment of trout and macroinvertebrate populations in project area on streams and at reference sites as based on field surveys.</i>	
For the Beaver Creek Mountain Improvements project, Forest Service personnel sampled and analyzed two sites on Beaver Creek for biological stream health and macroinvertebrates, one within and one outside the ski area boundary. No effects to trout and macroinvertebrate populations are expected under Alternative 1.	Under Alternative 2, the implementation of PDF would avoid and minimize potential erosion and sedimentation affects to aquatic habitat within and below the project area. Alternative 2 would maintain aquatic macroinvertebrate within the ski area but would result in minor perturbations to local, seasonal trout habitat and potential and occupied spawning reaches from environmental baseline conditions. However, Alternative 2 would not measurably contribute to any negative trend in the Forest-wide population or habitat trend of these MIS that would affect achieving Forest Plan MIS objectives.
<i>Indicator: Documentation of presence/absence of sensitive amphibians and their habitat within the project area.</i>	
No sensitive amphibians are documented as being present within the project area. While there are four known, extant boreal toad breeding sites in the vicinity of the project area, all are geographically isolated and well beyond the maximum known dispersal distances where individuals from those populations could disperse to habitats that would be impacted in the project area.	Same as Alternative 1.

**Table ES-2:
Summary of Environmental Consequences**

Alternative 1	Alternative 2
<i>Indicator: Identification of Lynx Analysis Unit (LAU) boundaries in relation to the project area.</i>	
The project area is located within the Eagle Valley LAU (EVLAU, WRNF LAU #20), defined and assigned by the USFS encompassing 117, 235 acres west of Vail Pass, including the south side of the Gore Range and the Eagles Nest Wilderness on the north, the Gore Creek Valley south of I-70, and the northern end of the Sawatch Range including the Holy Cross Wilderness and the Beaver Creek drainage. The narrow portion of the EVLAU containing the project area juts south into two LAUs: the Holy Cross LAU and the Brush Creek LAU, which are also considered herein as part of a functional habitat block.	Same as Alternative 1.
<i>Indicator: Quantification (acres) of effects on lynx habitat types.</i>	
Under Alternative 1, there would be no summer construction and hence no effect on lynx habitat.	Impacts to lynx habitat types would total 52.28 acres: 1.4% of the Beaver Creek SUP area or 0.04% of the LAU.
<i>Indicator: Determination of effects to Sensitive, Management Indicator, and Threatened/Endangered/ Candidate species.</i>	
Alternative 1 would not produce any additional effects to Sensitive, Management Indicator, or Threatened/Endangered/ Candidate species.	<ul style="list-style-type: none"> • Canada Lynx – May affect, likely to adversely affect • Colorado River Cutthroat Trout – no impact • Boreal western toad – no impact • Northern leopard frog – no impact • Northern goshawks – may impact individuals, but are not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing. • Northern Harrier – may impact individuals, but are not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing. • American Peregrine Falcon – may impact individuals, but are not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing. • Boreal owl – may impact individuals, but are not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing. • American Three-Toed Woodpecker – may impact individuals, but are not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing. • Olive-sided flycatchers – may impact individuals, but are not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.

**Table ES-2:
Summary of Environmental Consequences**

Alternative 1	Alternative 2
	<ul style="list-style-type: none"> • Pygmy shrews – may adversely impact individuals, but are not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing. • American Marten – may impact individuals, but are not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing. • North American Wolverine – may impact individuals, but are not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing. • American Elk – Alternative 2 would not measurably contribute to any negative trend in the DAU or Forest-wide population or habitat trend of this MIS that would affect achieving Forest Plan MIS objectives. • Aquatic macroinvertebrates – Alternative 2 would continue to provide aquatic macroinvertebrate habitat across the existing ski area and would not measurably contribute to any negative trend in the Forest-wide population or habitat trend of this MIS that would affect achieving Forest Plan MIS objectives. • All trout –Alternative 2, with PDFs would neither contribute towards, nor negatively affect, meeting aquatic MIS objectives at the Forest-wide scale.
VEGETATION	
Issue: Plant communities (including Threatened, Endangered, and Sensitive [TES] species, WRNF Species with an Identified Viability Concern (SIVC) and invasive plant species) may be impacted as a result of proposed projects.	
<i>Indicator: Identification of threatened and endangered plant species, and habitat, present in the project area.</i>	
The one threatened plant with potential to be present in the project area—Penland alpine fen mustard (<i>Eutrema penlandii</i>)—and its potential habitat were not located during four systematic plant surveys conducted throughout all potential disturbance areas.	Same as Alternative 1.
<i>Indicator: Identification of and effects to Region 2 sensitive plant species and habitat present in the project area.</i>	
Five R2 sensitive plant species (trianglelobe moonwort, slender moonwort, peculiar moonwort, yellow lady’s slipper, and dwarf raspberry) have potentially suitable habitat in the project area. Under Alternative 1 no change from the current conditions of species and habitat are expected.	While five R2 sensitive plant species had potentially suitable habitat in the project area, Alternative 2 would not have any significant direct impacts on any R2 sensitive plant species, as these species were not located in the project area.

**Table ES-2:
Summary of Environmental Consequences**

Alternative 1	Alternative 2
<i>Indicator: Identification of and effects to WRNF species with an identified viability concern and habitat present in the project area.</i>	
Five species of local concern were detected in the project area: three moonwort species, clustered lady slipper, and Alaskan Piperia. Under Alternative 1 no change from the current conditions of species and habitat are expected.	While unavoidable disturbance of any of the species of local concern would not present a viability concern range-wide, disturbance of the Alaskan piperia population found near the proposed water tank site may present a viability concern forest-wide because it is the only known population in the WRNF. In the event that some or all of the other two species of local concern populations would not be avoided, the loss of these individuals and populations would not present a viability concern Forest-wide or range-wide.
<i>Indicator: Quantification (acreage) of proposed ground disturbance and overstory vegetation removal.</i>	
No ground disturbance or overstory vegetation removal would occur under Alternative 1.	<p>Alternative 2 would impact 52.3 total acres, or 1.4% of the vegetation communities present within the Beaver Creek SUP. Approximately 32 ac of existing, graded ski trails and existing roads for snowmaking pipeline and other buried infrastructure installation would be impacted, with disturbance areas returned to predisturbance conditions. Approximately 20 acres would result in permanent tree removal. Impacted acres by vegetation type are as follows:</p> <ul style="list-style-type: none"> • Barren 4.6 acres • Forblands (FOR, almost entirely ski trails) 3.2 acres • Grassland (GRA, all ski trails) 23.97 acres • Spruce-fir (TSF) 11.65 acres • Lodgepole Pine (TLP) 1.15 acres • Mixed Conifer (TMC) 6.25 acres • Aspen (TAA) 1.22 acres • Blue spruce (TBS) 0.08 acre • Alder (SAL) 0.17 acre

**Table ES-2:
Summary of Environmental Consequences**

Alternative 1	Alternative 2
<i>Indicator: Identification of invasive species in the vicinity of the project area and use of BMPs to limit their spread.</i>	
<p>Six Colorado Class A and B noxious weeds were detected on and adjacent to project area:</p> <ul style="list-style-type: none"> • Mayweed chamomile • Musk thistle • Canada thistle • Bull thistle • Perennial pepperweed • Oxeye daisy <p>Under Alternative 1 no activities would be carried out that might increase the spread of invasive species.</p>	<p>In order to minimize the chances of spreading the six Class A/B noxious weeds found in the project area, BMPs for vegetation would be followed (refer to Table 2-1).</p>
<i>Indicator: Revegetation of the project area focusing on soil stabilization, water infiltration and habitat for wildlife and pollinators.</i>	
<p>Under Alternative 1 no ground would be disturbed so no revegetation would be necessary.</p>	<p>Table 2-1 includes Project Design Features and Best Management Practices designed to accommodate revegetation, soil stabilization, water infiltration, and habitat for wildlife and pollinators.</p>
SOIL RESOURCES	
Issue: Proposed ground disturbance and snowmaking may (individually and/or collectively) affect erosion and/or reduce soil organic matter.	
<i>Indicator: Discussion of site-specific soil conditions and depth of organic matter.</i>	
<p>No pedestals, rilling or other signs of overland flow were observed within the project area. The site has a mean depth of 3.9 cm of O horizon and 30 cm of A horizon.</p>	<p>The stockpiling and re-spreading native soil organic matter (O and A horizon material) and use organic amendments after grading (if deemed necessary and practical by USFS personnel), coupled with implementation of appropriate drainage management, would result in similar effects on erosion and loss of soil organic matter as the No Action alternative.</p>
<i>Indicator: Area (acres) of temporary and permanent disturbance according to high/moderate/low erodibility soil classes</i>	
<p>0 acres of disturbance would occur as a result of implementation of the No Action alternative. No effects are expected under Alternative 1.</p>	<p>45.1 acres of disturbance in Low erosion potential 5.5 acres of disturbance in Moderate erosion potential 0 acres of disturbance in High erosion potential</p>

**Table ES-2:
Summary of Environmental Consequences**

Alternative 1	Alternative 2
<i>Indicator: Analysis of increased erosion hazard due to ground disturbance</i>	
Soil susceptibility to erosion within the SUP area ranges from low to moderate. No soils with severe erosion hazard were identified.	Soil susceptibility to erosion within the project area ranges from low to moderate. No soils with severe erosion hazard were identified, therefore with implementation of a drainage management plan, erosion could be minimized.
<i>Indicator: Analysis of slope stability and geological constraints associated with project components</i>	
Landslide potential within the SUP area ranges from low to moderate.	All of the proposed projects occur within soils with low landslide potential. Use of the WRNF Landscape Stability Model predicted no areas of “Severe” or “High” risk within the areas of proposed soil disturbance; details of the modeled results are contained in the project file.
WATERSHED & WETLANDS	
Issue: Proposed ground disturbance (e.g., clearing, grading, and culverting Westfall Creek) and additional snowmaking may contribute sediment and reduce stream bank stability in Beaver Creek and affect riparian habitat, wetlands and fisheries.	
<i>Indicator: Quantification of changes in water yield or discharge to receiving streams from proposed snowmaking and grading.</i>	
No additional changes in water yield and peak flow would occur under Alternative 1. Water yield and peak flows would continue to resemble quantities presented in Table 3I-3.	Alternative 2 would cause the following increases in water yields and peak flows: <u>Westfall Creek:</u> <i>Water Yield:</i> 34.2 AF increase (2.9% relative to existing condition) <i>Peak Flows:</i> 0.5 cfs increase (4.6% relative to existing conditions) <u>Upper Beaver Creek:</u> <i>Water Yield:</i> 34.8 AF increase (0.5% relative to existing condition) <i>Peak Flows:</i> less than 0.1 cfs increase (0% relative to existing conditions)
<i>Indicator: Identification of clearing and grading in the Water Influence Zone (WIZ).</i>	
No additional impacts to the WIZ would occur under Alternative 1. Watersheds will continue to adjust to existing impacts.	Impacts to the WIZ account for 1.4 acres (1.8% of the currently forested WIZ) within the Westfall Creek watershed. This impact would be offset by PDF. No forest clearing is proposed in the Upper Beaver Creek’s WIZ. Construction and implementation of Alternative 2 would be consistent with the WCPH and should not adversely impact the health of Westfall Creek and Upper Beaver Creek.

**Table ES-2:
Summary of Environmental Consequences**

Alternative 1	Alternative 2
<i>Indicator: Quantification of connected disturbed areas (CDA) in the vicinity of the project area.</i>	
Current CDA within the Westfall Creek watershed totals approximately 4.5 acres.	Alternative 2 proposes to disconnect 2.7 acres of existing CDA within the Westfall Creek watershed. In addition, water bars and sediment control devices would be constructed on the proposed ski trails to ensure surface runoff drains away from the WIZ. Implementation of the proposed PDFs would “maintain” stream health in Westfall Creek and Upper Beaver Creek watersheds.
Issue: Project activities may cause changes in surface and groundwater hydrology that support streams and wetlands.	
<i>Indicator: Quantification of changes in water yield or discharge to receiving streams from proposed snowmaking and grading.</i>	
No changes in water yield and peak flow would occur under Alternative 1.	Alternative 2 would cause the following increases in water yields and peak flows: <u>Westfall Creek:</u> <i>Water Yield:</i> 34.2 AF increase (2.9% relative to existing condition) <i>Peak Flows:</i> 0.5 cfs increase (4.6% relative to existing conditions) <u>Upper Beaver Creek:</u> <i>Water Yield:</i> 34.8 AF increase (0.5% relative to existing condition) <i>Peak Flows:</i> less than 0.1 cfs increase (0% relative to existing conditions) These changes in yield and peak discharge would be negligible as compared to the natural variability of the area’s hydrology. Thus, the Proposed Alternative would not impact stream health in the study area.

**Table ES-2:
Summary of Environmental Consequences**

Alternative 1	Alternative 2
Issue: Additional snowmaking water use may impact the following: in-stream flows; aquatic habitat through diversion; and water yield. It also may exacerbate drainage problems within the project area.	
<i>Indicators: (1) Quantification of existing and proposed water depletions (acre feet [AF]) for snowmaking under all alternatives. (2) Quantification of total consumptive water losses (i.e., evaporation, evapotranspiration, sublimation) resulting from existing and proposed snowmaking.</i>	
<p>Under Alternative 1, water depletions for snowmaking would continue at the current annual average of 693.3 AF (total for entire Beaver Creek Ski Resort). Snowmaking water diversions are considered to be approximately 18 to 27% depletive, after consideration of return flows. However, the augmentation plans that protect Beaver Creek snowmaking diversions contain provisions that allow the snowmaking return flows to be reused for subsequent beneficial uses. Thus, for purposes of this analysis the snowmaking diversions are considered 100% depletive.</p>	<p>Under Alternative 2, snowmaking diversions will increase by approximately 34 AF, to total of 727 AF (a 5% increase). For purposes of this analysis, Beaver Creek snowmaking diversions are considered to be 100% depletive (see Alternative 1 description).</p> <p>In-stream flows and low-flow water yield would continue to be legally and physically protected per the corresponding decreed plans for augmentation. During periods when in-stream flows as decreed by the Colorado Water Conservation Board (CWCW) could place a call, upstream storage is released (Eagle River) or diversions are curtailed (Beaver Creek), as appropriate, effectively protecting in-stream flows. The legal and physical sources of water are adequate to support the existing and proposed snowmaking diversions at Beaver Creek. Impacts to in-stream flows, aquatic habitat and basin yield would not occur from implementation of Alternative 2.</p>
Issue: Proposed ground disturbance (e.g., clearing, grading, and culverting Westfall Creek) may affect the quantity of wetlands within the Study Area.	
<i>Indicator: Acres of wetlands proposed for disturbance.</i>	
<p>There is a total of 3.36 acres of wetlands within the Study Area. Under Alternative 1, no change is expected from existing conditions.</p>	<p>Flush-cutting approximately 0.07 acre of Palustrine Shrub/Scrub (PSS) wetland 4 vegetation (primarily willow) would result in increased amounts of solar radiation reaching the ground and increased available moisture, resulting in a conversion of wetland type to Palustrine Emergent Wetlands (PEM). Despite the change, wetland 4 would still exhibit hydrologic and habitat functions and values.</p>

Table of Contents

TABLE OF CONTENTS

1. PURPOSE AND NEED	1-1
A. INTRODUCTION	1-1
B. BACKGROUND.....	1-2
C. RELATIONSHIP TO PREVIOUS ANALYSES AND APPROVALS	1-3
D. PURPOSE AND NEED FOR THE PROPOSED ACTION.....	1-4
E. SUMMARY OF THE PROPOSED ACTION	1-6
<i>Race Terrain</i>	<i>1-7</i>
<i>Racecourse Finish Area</i>	<i>1-7</i>
<i>Guest Services</i>	<i>1-7</i>
<i>Infrastructure Projects</i>	<i>1-7</i>
F. PUBLIC INVOLVEMENT	1-8
G. ISSUES AND INDICATORS	1-8
<i>Human Environment</i>	<i>1-9</i>
<i>Biological Environment</i>	<i>1-10</i>
H. SCOPE OF THE ANALYSIS	1-13
I. CONSISTENCY WITH FOREST SERVICE POLICY	1-13
<i>Land and Resource Management Plan Consistency</i>	<i>1-13</i>
J. DECISION TO BE MADE.....	1-14
K. OTHER NECESSARY PERMITS, LICENSES, ENTITLEMENTS AND/OR CONSULTATION.....	1-15
2. DESCRIPTION OF ALTERNATIVES	2-1
A. INTRODUCTION	2-1
B. ALTERNATIVES CONSIDERED IN DETAIL.....	2-1
<i>Alternative 1 – No Action.....</i>	<i>2-1</i>
<i>Alternative 2 – The Proposed Action</i>	<i>2-2</i>
C. ALTERNATIVES AND DESIGN COMPONENTS CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS ...	2-5
D. PROJECT DESIGN FEATURES INCORPORATED INTO ALTERNATIVE 2.....	2-6
3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES.....	3-1
A. RECREATION	3-3
<i>Scope of the Analysis.....</i>	<i>3-3</i>
<i>Affected Environment.....</i>	<i>3-3</i>
<i>Direct and Indirect Environmental Consequences.....</i>	<i>3-7</i>
<i>Cumulative Effects</i>	<i>3-11</i>
<i>Irreversible and Irretrievable Commitment of Resources.....</i>	<i>3-11</i>
B. TRAFFIC, PARKING, AND SKI AREA ACCESS	3-12
<i>Scope of the Analysis.....</i>	<i>3-12</i>
<i>Affected Environment.....</i>	<i>3-12</i>
<i>Direct and Indirect Environmental Consequences.....</i>	<i>3-18</i>
<i>Cumulative Effects</i>	<i>3-22</i>
<i>Irreversible and Irretrievable Commitments of Resources</i>	<i>3-22</i>
C. SCENERY	3-23
<i>Scope of the Analysis.....</i>	<i>3-23</i>
<i>Management of the Scenic Environment on National Forest System Lands</i>	<i>3-23</i>
<i>Affected Environment.....</i>	<i>3-27</i>
<i>Direct and Indirect Environmental Consequences.....</i>	<i>3-29</i>
<i>Cumulative Effects</i>	<i>3-30</i>
<i>Irreversible and Irretrievable Commitments of Resources</i>	<i>3-31</i>
D. SOCIAL AND ECONOMIC RESOURCES	3-32
<i>Scope of the Analysis.....</i>	<i>3-32</i>
<i>Affected Environment.....</i>	<i>3-32</i>
<i>Direct and Indirect Environmental Consequences.....</i>	<i>3-36</i>
<i>Cumulative Effects</i>	<i>3-38</i>

Table of Contents

<i>Irreversible and Irretrievable Commitments of Resources</i>	<i>3-39</i>
E. AIR QUALITY	3-40
<i>Scope of the Analysis.....</i>	<i>3-40</i>
<i>Regulatory Direction.....</i>	<i>3-40</i>
<i>Affected Environment.....</i>	<i>3-44</i>
<i>Direct and Indirect Environmental Consequences.....</i>	<i>3-47</i>
<i>Cumulative Effects</i>	<i>3-51</i>
<i>Irreversible and Irretrievable Commitment of Resources.....</i>	<i>3-51</i>
F. WILDLIFE	3-52
<i>Scope of the Analysis.....</i>	<i>3-52</i>
<i>Affected Environment.....</i>	<i>3-52</i>
<i>Direct and Indirect Environmental Consequences.....</i>	<i>3-65</i>
<i>Cumulative Effects</i>	<i>3-77</i>
<i>Irreversible and Irretrievable Commitments of Resources</i>	<i>3-85</i>
G. VEGETATION.....	3-86
<i>Scope of the Analysis.....</i>	<i>3-86</i>
<i>Affected Environment.....</i>	<i>3-87</i>
<i>Direct and Indirect Environmental Consequences.....</i>	<i>3-93</i>
<i>Cumulative Effects</i>	<i>3-97</i>
<i>Irreversible and Irretrievable Commitment of Resources.....</i>	<i>3-98</i>
H. SOIL RESOURCES	3-99
<i>Scope of the Analysis.....</i>	<i>3-99</i>
<i>Forest Plan Direction</i>	<i>3-99</i>
<i>Affected Environment.....</i>	<i>3-100</i>
<i>Direct and Indirect Environmental Consequences.....</i>	<i>3-101</i>
<i>Cumulative Effects</i>	<i>3-103</i>
<i>Irreversible and Irretrievable Commitments of Resources</i>	<i>3-104</i>
I. WATER RESOURCES	3-105
<i>Scope of the Analysis.....</i>	<i>3-105</i>
<i>Forest Plan Direction</i>	<i>3-105</i>
<i>Affected Environment.....</i>	<i>3-107</i>
<i>Direct and Indirect Environmental Consequences.....</i>	<i>3-113</i>
<i>Cumulative Effects</i>	<i>3-123</i>
<i>Irreversible and Irretrievable Commitment of Resources.....</i>	<i>3-124</i>
J. WETLANDS	3-125
<i>Scope of the Analysis.....</i>	<i>3-125</i>
<i>U.S. Army Corps of Engineers Direction.....</i>	<i>3-125</i>
<i>Forest Plan Direction</i>	<i>3-125</i>
<i>Executive Order 11990</i>	<i>3-126</i>
<i>Affected Environment.....</i>	<i>3-127</i>
<i>Direct and Indirect Environmental Consequences.....</i>	<i>3-129</i>
<i>Cumulative Effects</i>	<i>3-130</i>
<i>Irreversible and Irretrievable Commitment of Resources.....</i>	<i>3-130</i>
K. CULTURAL, ARCHAEOLOGICAL, AND HERITAGE RESOURCES	3-131
<i>Scope of the Analysis.....</i>	<i>3-131</i>
<i>Affected Environment.....</i>	<i>3-131</i>
<i>Direct and Indirect Environmental Consequences.....</i>	<i>3-132</i>
<i>Cumulative Effects</i>	<i>3-132</i>
<i>Irreversible and Irretrievable Commitments of Resources</i>	<i>3-133</i>
4. CONSULTATION AND COORDINATION	4-1
A. PREPARERS	4-1
<i>Forest Service Team.....</i>	<i>4-1</i>
<i>Consultant Team</i>	<i>4-1</i>
B. AGENCIES, ORGANIZATIONS, TRIBAL GOVERNMENTS, AND PERSONS CONTACTED.....	4-2

<i>Federal Government</i>	4-2
<i>Tribal Government</i>	4-3
<i>State Government</i>	4-3
<i>Local Government</i>	4-3
<i>Individuals Who Commented During the DEIS</i>	4-3
5. REFERENCES	5-1
6. FIGURES	6-1
LOCATION MAP	
FIGURE 1: ALTERNATIVE 1 – NO ACTION	
FIGURE 2: ALTERNATIVE 2 – PROPOSED ACTION	
FIGURE 3: WATER RESOURCES	
7. GLOSSARY	7-1
8. INDEX	8-1
APPENDICES – APPENDIX A: CUMULATIVE EFFECTS PROJECTS	

LIST OF TABLES

TABLE 2-1: PROJECT DESIGN FEATURES AND BEST MANAGEMENT PRACTICES.....	2-7
TABLE 3B-1: AADT (YEAR 2010) ALONG I-70	3-14
TABLE 3B-2: LOS BETWEEN MILE MARKER 163 AND 180	3-15
TABLE 3B-3: AVERAGE DAILY TRAFFIC CONTRIBUTIONS TO I-70 ASSOCIATED WITH BEAVER CREEK’S WINTER OPERATIONS	3-15
TABLE 3B-4: AVERAGE DAILY TRAFFIC CONTRIBUTIONS TO I-70 ASSOCIATED WITH BEAVER CREEK’S <i>BIRDS OF PREY</i> WORLD CUP EVENT	3-16
TABLE 3B-5: PARKING LOTS AND CAPACITIES – EXISTING CONDITIONS	3-17
TABLE 3E-1: NATIONAL AMBIENT AIR QUALITY STANDARDS FOR CRITERIA POLLUTANTS	3-41
TABLE 3E-2: CO ₂ E GENERATED BY THE ALTERNATIVES	3-48
TABLE 3F-1: ALTERNATIVE 2 IMPACTS TO LYNX HABITAT TYPES WITHIN THE BEAVER CREEK SUP AREA	3-67
TABLE 3F-2: CHANGES TO LYNX HABITAT IN THE EAGLE VALLEY LAU	3-68
TABLE 3F-3: TOTAL TRAFFIC CONTRIBUTIONS TO REGIONAL HIGHWAY SEGMENT(S) CROSSING THROUGH DESIGNATED LYNX LINKAGE AREAS	3-69
TABLE 3G-1: VEGETATION COMMUNITIES AND ACREAGE WITHIN THE BEAVER CREEK SUP AREA.....	3-87
TABLE 3G-2: COLORADO CLASS A AND B NOXIOUS WEEDS IN THE PROJECT AREA	3-88
TABLE 3G-3: WHITE RIVER NATIONAL FOREST PLANT SPECIES OF LOCAL CONCERN THAT MAY OCCUR IN THE PROJECT AREA.....	3-92
TABLE 3G-4: ALTERNATIVE 2 IMPACTS TO VEGETATION COMMUNITIES	3-94
TABLE 3G-5: R2 SENSITIVE PLANT SPECIES IN THE PROJECT AREA	3-95
TABLE 3H-1: SOIL MANAGEMENT UNITS IDENTIFIED WITHIN THE SUP BOUNDARY	3-100
TABLE 3H-2: GROUND DISTURBANCE BY WATERSHED	3-102
TABLE 3I-1: BEAVER CREEK RESORT’S WATERSHEDS – EXISTING CONDITIONS	3-108
TABLE 3I-2: SNOWMAKING COVERAGE ON BEAVER CREEK RESORT’S WATERSHEDS – EXISTING CONDITIONS....	3-108
TABLE 3I-3: WRENNS MODEL OUTPUT FOR BASELINE & EXISTING CONDITIONS – AVERAGE YEAR	3-109
TABLE 3I-4: WRENNS MODEL OUTPUT FOR EXISTING CONDITIONS – DRY, AVERAGE, AND WET YEARS.....	3-109
TABLE 3I-5: STREAM HEALTH CLASSES FOR ATTAINMENT OF FOREST PLAN STANDARDS (WCPH).....	3-110
TABLE 3I-6: IMPACTS TO THE FORESTED AREAS WITHIN BEAVER CREEK RESORT’S WATERSHEDS – EXISTING CONDITIONS.....	3-111
TABLE 3I-7: IMPACTS TO THE WIZ WITHIN BEAVER CREEK RESORT’S WATERSHEDS – EXISTING CONDITIONS....	3-111
TABLE 3I-8: CONNECTED ROADS WITHIN BEAVER CREEK RESORT’S STUDY WATERSHEDS – EXISTING CONDITIONS.....	3-112
TABLE 3I-9: CDA WITHIN BEAVER CREEK RESORT’S STUDY WATERSHEDS – EXISTING CONDITIONS.....	3-112
TABLE 3I-10: FOREST CLEARING – PROPOSED ACTION.....	3-114
TABLE 3I-11: SNOWMAKING COVERAGE AND ASSOCIATED WATER DEMANDS.....	3-114
TABLE 3I-12: ESTIMATED INCREASE IN ANNUAL YIELD UNDER THE PROPOSED ACTION – AVERAGE YEAR CONDITIONS	3-115
TABLE 3I-13: ESTIMATED INCREASE IN PEAK FLOWS UNDER THE PROPOSED ACTION – AVERAGE YEAR CONDITIONS	3-116
TABLE 3J-1: WETLANDS IDENTIFIED WITHIN THE STUDY AREA.....	3-129

LIST OF ACRONYMS

AADT	Average Annual Daily Traffic
AAQS	Ambient Air Quality Standards
ADT	Average Daily Traffic
AF	Acre-feet
AMSL	Above Mean Sea Level
AVO	Average Vehicle Occupancy
BA	Biological Assessment
BE	Biological Evaluation
BEIG	Built Environment Image Guide
BMP	Best Management Practice
CAA	Clean Air Act
CCC	Comfortable Carrying Capacity
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
CWA	Clean Water Act
DMP	Drainage Management Plan
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EO	Executive Order
ESA	Endangered Species Act
FIS	International Ski Federation
FSH	Forest Service Handbook
FSM	Forest Service Manual
GIS	Geographic Information System
ID Team	Interdisciplinary Team
LRMP	Land and Resource Management Plan
MA	Management Areas
mg/l	Milligrams per liter
µg	Micrograms
MIS	Management Indicator Species
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NFS	National Forest System
NHPA	National Historic Preservation Act
NO ₂	Nitrogen Dioxide
NO _x	Nitrogen Oxide

List of Acronyms

NOI	Notice of Intent
NRHP	National Register of Historic Places
PDF	Project Design Features
PM _{2.5}	Particulate Matter under 2.5 microns
PM ₁₀	Particulate Matter under 10 microns
PPH	People Per Hour
PSD	Prevention of Significant Deterioration
ROD	Record of Decision
SAOT	Skiers-at-one-time
SIO	Scenic Integrity Objective
SO ₂	Sulfur Dioxide
SUP	Special Use Permit
TES	Threatened, Endangered, and Sensitive species
TMDL	Total Maximum Daily Load
TOC	Threshold of Concern
USACE	US Army Corps of Engineers
USC	United States Code
USCA	United States Code Annotated
USDA	United States Department of Agriculture
USFS	US Forest Service
USFWS	US Fish and Wildlife Service
USGS	US Geological Survey
WCPH	Watershed Conservation Practices Handbook
WEPP	Water Erosion Prediction Project
WIZ	Water Influence Zone
WRNF	White River National Forest

Chapter 1

Purpose and Need

1. PURPOSE AND NEED

A. INTRODUCTION

The proposed projects at Beaver Creek Resort (hereinafter referred to as “Beaver Creek”) analyzed in this document constitute a federal action which has the potential to affect the quality of the human environment on public lands administered by the United States Department of Agriculture Forest Service (Forest Service). Therefore, these projects must be analyzed pursuant to the National Environmental Policy Act of 1969 (NEPA). Under NEPA, federal agencies must carefully consider environmental concerns in their decision making processes and provide relevant information to the public for review and comment.

The Forest Service has prepared this Final Environmental Impact Statement (FEIS) in compliance with NEPA and other relevant federal and state laws and regulations. This FEIS contains analyses consistent with NEPA, Council on Environmental Quality (CEQ) regulations, and Forest Service policy. It discloses potential direct, indirect, and cumulative environmental effects on the human and biological environment anticipated to result with implementation of the Proposed Action or an additional action alternative. Additionally, it is intended to ensure that planning reflects the environmental and social values of the project area and that potential resource conflicts are minimized or avoided. The document is organized into eight chapters:

- **Chapter 1 – Purpose and Need:** includes information on the history of the project proposal, the purpose of and need for the project, and the proposal for achieving that Purpose and Need. Chapter 1 also details how the Forest Service informed the public of the proposal and how the public responded.
- **Chapter 2 – Description of Alternatives:** provides a detailed description of the two alternatives that are analyzed in detail—No Action and the Proposed Action. This discussion also includes alternatives considered but eliminated from further analysis and mitigation measures.
- **Chapter 3 – Affected Environment and Environmental Consequences:** provides a description of the affected environment (i.e., existing conditions) according to resource area and describes the environmental effects of implementing the No Action Alternative and the Proposed Action. Chapter 3 is organized by resource topic.
- **Chapter 4 – Consultation and Coordination:** provides a list of preparers and agencies consulted during the development of this EIS.
- **Chapter 5 – References:** provides complete references for documents cited within this EIS.
- **Chapter 6 – Figures:** includes the figures that are referred to throughout the analysis.

- **Chapter 7 – Glossary:** provides a definition of technical and non-technical terms used throughout this EIS.
- **Chapter 8 – Index:** provides a list and page number of frequently used terms throughout this EIS.
- **Appendices – Appendix A: Cumulative Effects:** includes a table of cumulative effects projects and project descriptions.

Additional documentation, including more detailed analyses of project area resources, may be found in the project administrative record located at the Eagle/Holy Cross Ranger District office of the White River National Forest (WRNF).

B. BACKGROUND

Beaver Creek is located on the Eagle/Holy Cross Ranger District of the WRNF, approximately 100 miles west of Denver, the largest metropolitan area in Colorado. The resort is accessed from the Front Range communities of Denver, Boulder, Fort Collins, and Colorado Springs via Interstate 70. Beaver Creek opened to the public for lift-served Alpine skiing on December 15, 1980, giving it the distinction as the last new ski area permitted on NFS lands. Over three decades, Beaver Creek has become a unique and popular source of year-round recreational opportunities on public lands managed by the WRNF.

Beaver Creek operates under a Forest Service Special Use Permit (SUP) issued to Beaver Creek Associates (a subsidiary of Vail Associates, Inc.). The 40-year SUP covers approximately 3,849 acres of the WRNF, and was re-issued in November 1999. The terms of the SUP require Beaver Creek to submit a Master Development Plan (MDP) to the WRNF, which identifies goals and opportunities for future management of the ski area on National Forest System (NFS) lands. Accordingly, an update to its MDP was prepared and submitted to the WRNF in 2010, which was accepted.

Alpine ski racing is a unique and important component of Beaver Creek's culture, and is something that sets it apart from other ski areas in the United States. That being said, a core objective of Beaver Creek's 2010 MDP Update is to "update mountain facilities and infrastructure related to ski racing to continue to provide world class venues for Alpine events."¹

Beaver Creek is home to the *Birds of Prey* racecourse, on which it hosts men's World Cup Downhill, Super G, and Giant Slalom events. As the only current venue in the United States for men's World Cup races, *Birds of Prey* has become one of the favorite (and the first) stops on the men's World Cup circuit. Constructed for the 1999 World Alpine Ski Championships, and designed by Olympic Downhill gold medalist Bernhard Russi of Switzerland, the course starts west of the top of the Cinch Express,

¹ Beaver Creek Resort, 2010 p. 7

descending 2,590 vertical feet to Red Tail Camp on *Zoom Room* and *Golden Eagle*. *Birds of Prey* is recognized as one of the premier racecourses in the world.

Beaver Creek does not have women's Downhill or Giant Slalom racecourses and the *Birds of Prey* course does not meet the Fédération Internationale de Ski/International Ski Federation (FIS) technical requirements to host women's events. The absence of a women's race venue currently precludes Beaver Creek from hosting some international Alpine events.

C. RELATIONSHIP TO PREVIOUS ANALYSES AND APPROVALS

This FEIS is consistent with, and incorporates by reference, several documents that are related to the management of NFS lands at Beaver Creek, including:

1976 Environmental Analysis Report, Beaver Creek Winter Sports Site and Year Round Recreation Area

- The 1976 EAR outlined the proposed development of the ski terrain on the public lands that make up a substantial portion of the Beaver Creek Resort. The 1976 EAR has been fully implemented.

1998 Environmental Assessment, Snowmaking Master Plan, Beaver Creek Resort

- The 1998 Environmental Assessment, Snowmaking Master Plan approved the installation of snowmaking on an additional 130 acres of terrain. The Snowmaking Plan has not been fully implemented.

2002 Revision to the White River Forest Land and Resource Management Plan

- The 2002 revision to the 1985 WRNF Land and Resource Management Plan provides forest-wide and specific Management Area 8.25 direction for operations and activities within Beaver Creek's SUP area. The 2002 revision added McCoy Park and the Stone Creek drainage to the existing permit and removed the Mud Springs area from the 8.25 prescription.

2002 Final Environmental Assessment, Gondola Proposal, Beaver Creek Resort

- Approved the portion of a proposed gondola that would be constructed from the Tarnes area, through Bachelor Gulch and up to the summit of Chair 12 in Beaver Creek. Only the final 3,000 feet of the lift would be on Forest Service lands. This project was modified and implemented as two detachable chairlifts.

2005 Environmental Assessment, Stone Creek, Beaver Creek Resort

- Approved the construction of access and egress routes to the Stone Creek Chutes.

2011 Environmental Assessment, Beaver Creek Ski Area Forest Health Project

- Approved vegetative treatments on 553 acres within the Special Use Permit Area affected by Mountain Pine Beetle.

Annual Winter and Summer Operations Plans, Beaver Creek Resort

- Prepared annually.

Annual Summer Construction Plans, Beaver Creek Resort

- Prepared annually.

D. PURPOSE AND NEED FOR THE PROPOSED ACTION

The Purpose and Need for Action is a subset of the goals and objectives identified in Beaver Creek's 2010 MDP Update. It is noteworthy that in 2010, the FIS awarded Vail/Beaver Creek the opportunity to host the upcoming 2015 World Alpine Ski Championships, which are held every two years—always at a different venue. In order for Beaver Creek to continue to host international Alpine race events (including, but not limited to the 2015 World Alpine Ski Championships) and provide the highest quality experience for large numbers of racers and spectators, a number of trail and infrastructure projects are necessary. The Purpose and Need also addresses ongoing infrastructural and guest service needs that are not specifically related to Alpine ski racing. These projects were identified in Beaver Creek's 2010 MDP Update, and were specifically proposed to address the following resort goals and objectives:²

- Update mountain facilities and infrastructure in order to provide the highest quality guest experience possible;
- Update mountain facilities and infrastructure related to ski racing to continue to provide world class venues for Alpine events; and
- Update guest services across the resort to respond to the needs and demands of Beaver Creek's market.

Beaver Creek and Vail Mountain hosted the 1989 and 1999 World Alpine Ski Championships, and Beaver Creek has maintained continued involvement in the World Cup race circuit ever since. Hosting the 2015 World Alpine Ski Championships is a unique opportunity to increase the awareness and participation in the sport of skiing; however, the FIS requires separate venues for men's and women's Alpine events, which Beaver Creek currently does not offer.

The Purpose and Need for the Proposed Action falls into four general categories: Trails (Terrain and Snowmaking), Racecourse Finish Area, Red Tail Camp Restaurant, and Infrastructure. Specific projects that have been designed in response to this Purpose and Need for Action are summarized later in this document.

² Ibid.

Need #1

Improve upon/expand terrain to meet International Ski Federation (FIS) requirements for both men's and women's Alpine race events.

Beaver Creek currently provides one of the most difficult men's Downhill racecourses on the international World Cup circuit. The course, known as *Birds of Prey*, begins at the top of *Zoom Room* and continues down *Golden Eagle* to the finish at Red Tail Camp. This course can also accommodate men's Super G and Giant Slalom races; however, Beaver Creek does not have women's Downhill or Giant Slalom racecourses and the *Birds of Prey* racecourse does not meet the FIS technical requirements to host women's events. The absence of a women's race venue precludes Beaver Creek from hosting some international Alpine events (including the 2015 World Alpine Ski Championships). Consequently, there is a need for race terrain on the upper mountain sufficient to accommodate a women's race venue that meets FIS requirements.

In addition, several areas along the existing *Birds of Prey* racecourse have technical issues that present challenges to Beaver Creek. Due to existing terrain inconsistencies along *Zoom Room* and *Golden Eagle*, substantial amounts of man-made snow are required to prepare the racecourse each season for the World Cup event. Therefore, modifications to reduce site specific snowmaking needs on *Zoom Room* and *Golden Eagle* are needed if Beaver Creek is to continue to provide an exceptional race venue for the *Birds of Prey* men's World Cup event. In addition, upgrading and installing new snowmaking infrastructure on racecourse trails are needed to ensure that Alpine events could be accommodated during low natural snow conditions.

Finally, there is a need to accommodate spectator access along existing and proposed racecourses within the *Birds of Prey Express* pod and on Grouse Mountain.³

Need #2

Provide a racecourse finish area that meets FIS requirements for larger Alpine race events.

The current race finish area is too small to accommodate the facilities required by the FIS for the 2015 World Alpine Ski Championships, and is constrained on the northeast side by a steep slope and by the restaurant which is located in the middle of the area. The FIS requires that the finish corral (where the racers finish) be surrounded by a spectator area (estimated at 10,000 to 12,000 attendees), as well as a variety of media, coach and athlete supporting facilities. The current finish area can comfortably hold 4,000 attendees.

To meet FIS capacity requirements, there is a need for a racecourse finish area that provides sufficient support facilities and sufficient space to host at least an additional 6,000 attendees.

³ "Pod" is defined as a lift and the terrain in which it is generally associated.

Need #3

Improve on-mountain guest services to accommodate the general public throughout the year and during Alpine race events.

Red Tail Camp is an essential upper mountain component of Beaver Creek's on-mountain guest services. It provides guest services for skiers and riders using the Grouse Mountain Express, Birds of Prey Express, and Larkspur Express lifts. It is also the hub of guest services at the finish area of the *Birds of Prey* racecourse. The existing Red Tail Camp facility has a total seating capacity of 475 seats (269 indoor and 206 outdoor), which is undersized for the number of users on a typical weekend day; the deficiency of on-mountain dining is an identified constraint in the 2010 MDP Update. The desired capacity for a restaurant in this area is approximately 750 indoor/outdoor seats. This deficiency is exacerbated during racing events. In addition, the restaurant is located more than 30 vertical feet above the Larkspur Express run-out making it difficult to access for skiers and riders egressing from *Larkspur Bowl*.

Need #4

Respond to key infrastructural deficiencies related to race storage, water delivery and wastewater.

Storage

The existing storage facility located at the top of the Birds of Prey Express is undersized to meet the needs of current and future race events. A larger storage facility in the current location is needed to accommodate storage for the existing and future Alpine race events.

Water Tank

An existing 156,000-gallon water tank located at Spruce Saddle services Beano's Cabin and Red Tail Camp. This tank provides sufficient supply and domestic water pressure for existing facilities; however, additional water and improvements to the distribution system are necessary for fire suppression. Additional water storage and flow pressure would also be necessary if on-mountain guest service facilities at Red Tail Camp are enlarged.

Dally Sewer Line

The existing sewer line that extends from Red Tail Camp and downhill along *Dally* to where it joins with the Eagle River Water and Sanitation District line is at capacity. Regardless of whether new facilities are authorized, there is a need for an upgraded sewer line servicing the Red Tail Camp area.

E. SUMMARY OF THE PROPOSED ACTION

The Proposed Action was assembled in response to the previously identified Purpose and Need for Action. The Proposed Action can be broken down into four categories: race terrain; racecourse finish area; guest services; and infrastructure. The proposed projects are confined within Beaver Creek's SUP boundary (and within the existing lift/trail network), with the exception of a proposed upgraded sewer line on *Dally*, which extends beyond Red Tail Camp and onto adjacent private lands.

A summary of the Proposed Action is provided here, and a detailed description is presented in Chapter 2.

RACE TERRAIN

- Construct a women's Downhill course in the Birds of Prey Express pod, which necessitates widening *Flattops* and *Peregrine*, construction of two new trail segments, and snowmaking infrastructure installation/ replacement on upper *Flattops*, *Peregrine* and the new trail segments.
- Construct a women's Giant Slalom course on Grouse Mountain, which necessitates widening existing trails, construction of a new connector trail between *Raven Ridge* and lower *Golden Eagle* and upgrading snowmaking infrastructure on *Raven Ridge*.
- Improve the existing *Birds of Prey* men's racecourse, necessitating trail widening just above *Westfall Road* and strategic re-grading along the racecourse to reduce the need for snowmaking.
- Construct a new access trail between *Goshawk*, *Peregrine* and *Golden Eagle* that would enable event spectators to reach the middle portion of the men's *Birds of Prey* racecourse and women's Downhill course.
- Widen an existing utility corridor between *Red Tail* trail and the *Dally* catwalk to improve skier/rider circulation for race spectators descending to Red Tail Camp from the top of the Centennial Express.

RACECOURSE FINISH AREA

- Re-grade the entire Red Tail Camp race finish area.
- Replace and realign the culverted portion of Westfall Creek that runs through the Red Tail Camp area and culvert an approximate 150-foot stretch of Westfall Creek.
- Relocate existing utility lines throughout the Red Tail Camp area.
- Expand the TV compound to accommodate current and future media needs related to Alpine racing events.

GUEST SERVICES

- Relocate and replace Red Tail Camp with a larger building (increasing the capacity to roughly 600 indoor/160 outdoor seats).

INFRASTRUCTURE PROJECTS

- Install a 24 x 36-foot storage facility west of the top terminal of the Birds of Prey Express.
- Construct a new 150,000-gallon water tank and pump station on the edge of *Paint Brush*, adjacent the *Beaver Creek Expressway*.

- Install a new water line from the proposed 150,000-gallon water tank to the Beano's Cabin water line.
- Upgrade the existing 4-inch domestic water line from Beano's Cabin to Red Tail Camp to an 8-inch water line.
- Install approximately 3,000 feet of new sewer line from Red Tail Camp down *Dally* (extending north onto private land).

F. PUBLIC INVOLVEMENT

On December 3, 2010 a scoping package was mailed to approximately 35 community residents, interested individuals, public agencies, and other organizations. The scoping package provided a brief description of the Proposed Action, the Purpose and Need for Action, and an illustrative map. This information was specifically designed to elicit comments, concerns, and issues pertaining to the Proposed Action. A legal notice was published in the Glenwood Post Independent, and a Notice of Intent (NOI) to prepare an EIS was published in the Federal Register, on December 14, 2010. A public open house was held on January 6, 2011, at the Avon Public Library. In addition, the scoping package was posted on the WRNF website.

Based on the 41 letters received during scoping, a comment disposition was completed, which documents the Forest Service ID Team's categorization of each substantive comment. The comment disposition was prepared to identify issues and the formulation of potential alternatives to the Proposed Action. The issues are specifically addressed in Chapter 3 – Affected Environment and Environmental Consequences, of the Draft and Final EIS.

The Draft EIS was released for a 45-day comment period on November 25, 2011. The Forest Service received 29 letters during the comment period—24 in support, 2 in opposition, 1 neutral and 2 from federal agencies (Environmental Protection Agency and US Fish and Wildlife Service). Substantive comments provided on the Draft EIS are formally responded to in the Response to Comments.

G. ISSUES AND INDICATORS

Based on the results of internal and public scoping, the Forest Service identified specific issues to address. Issues generally require in-depth analysis and disclosure, and are utilized to generate alternatives. In some cases, they can be addressed by project design features or mitigation measures. Each of the following issue statements includes a list of indicators which were identified as a means of measuring or quantifying the anticipated level of impact on a particular resource. While some indicators are necessarily qualitative in nature, every effort was made to utilize indicators that are quantitative, measurable, and predictable.

HUMAN ENVIRONMENT

Recreation

Issue: Proposed projects within the Birds of Prey and Grouse Mountain pods would alter Beaver Creek's ability to accommodate public skiing and to host Alpine race events.

Issue: Construction work on these courses and the Red Tail Camp expansion may limit access for hiking, biking and skiing for one to two years.

Analytical Indicators & Requirements:

- Qualitative discussion of Beaver Creek's ability to host FIS-sanctioned race events under all alternatives.
- Quantitative and qualitative analysis of existing and proposed guest service facilities and infrastructure.
- Duration and extent of terrain closures on Grouse Mountain and Birds of Prey that would affect public skiing and summer recreational trail use.

Parking and Traffic

Issue: The Proposed Action may have effects on traffic on Interstate 70 and through the Town of Avon, as well as day skier parking.

Analytical Indicators & Requirements:

- Quantification of existing and projected traffic on Interstate 70 related to Beaver Creek's winter operations, including the annual Birds of Prey World Cup event.
- Quantification of parking capacities for day skiers, media and spectators.
- Qualitative analysis of existing and proposed race event access.

Scenery

Issue: Proposed projects may be visible from identified critical viewpoints.

Analytical Indicators & Requirements:

- Discussion of the Scenic Integrity Objectives (SIO) for the project area, as defined by the 2002 WRNF Land and Resource Management Plan.
- Documentation of the incremental effects to the scenic environment resulting from implementation of the proposed projects compared to historic landscape alterations within the SUP area.
- Discussion of the Forest Service's Built Environment Image Guide (BEIG) as applicable to existing and proposed guest service facilities.

- Viewshed analysis, from identified critical viewpoints, of proposed landscape alterations as compared to the existing condition.

Social and Economic Factors

Issue: Alpine ski race events hosted at Beaver Creek under each alternative may impact social and economic resources in the area.

Analytical Indicators & Requirements:

- Analysis of historic and projected visitor spending (at the local and state levels) resulting from hosting annual World Cup events and the World Alpine Skiing Championships.
- Projected long-term/short-term and direct/indirect employment under all alternatives.

Air Quality

Issue: Short-term, construction related activity, as well as potential increases in vehicular traffic related to increased spectator and media capacity for the 2015 World Alpine Ski Championships, could impact air quality in the region.

Analytical Indicators & Requirements:

- Estimation of existing and predicted emissions associated with Beaver Creek's operations and spectator events.
- Discussion/quantification of estimated greenhouse gas emissions associated with spectator events under all alternatives.
- Compliance with local, state and federal regulations regarding air quality.

Cultural

Issue: Proposed projects and associated ground disturbing activities may affect known or unidentified cultural resources.

- Discussion of cultural surveys completed to date in the vicinity of the project area.
- Inventory project area for cultural resources and historic properties.

BIOLOGICAL ENVIRONMENT

Wildlife and Aquatic Species

Issue: Implementation of proposed projects (including construction and use) could affect Threatened, Endangered and Sensitive (TES) and Management Indicator (MIS) wildlife and aquatic species.

Analytical Indicators & Requirements:

- Identification and analysis of alternatives on threatened and endangered aquatic species and habitat present in the project area. Consultation may be required for effects of water depletion on big river endangered fish as a result of new snowmaking.
- Identification and analysis of alternatives of Region 2 sensitive aquatic (fish and amphibian) species and habitat present in the project area.
- Analysis of physical stream health in the project area and the effects on aquatic life.
- Assessment of trout and macroinvertebrate populations in project area on streams and at reference sites as based on field surveys.
- Documentation of presence/absence of sensitive amphibians and their habitat within the project area.
- Identification of LAU boundaries in relation to the project area.
- Quantification (acres) of effects on Canada lynx habitat types.
- Determination of effects to Sensitive, Management Indicator, and Threatened/Endangered/Candidate species.

Vegetation

Issue: Plant communities (including Threatened, Endangered, and Sensitive [TES] species, WRNF Species with an Identified Viability Concern (SIVC) and invasive plant species) may be impacted as a result of proposed projects.

Analytical Indicators & Requirements:

- Identification of threatened and endangered plant species, and habitat, present in the project area.
- Identification of Region 2 sensitive plant species and habitat present in the project area.
- Identification of WRNF species with an identified viability concern and habitat present in the project area.
- Quantification (acreage) of proposed ground disturbance and overstory vegetation removal.
- Identification of invasive species in the vicinity of the project area and use of BMPs to limit their spread.
- Revegetation of the project area focusing on soil stabilization, water infiltration and habitat for wildlife and pollinators.

Soil Resources

Issue: Proposed ground disturbance and snowmaking may (individually and/or collectively) increase erosion and reduce soil organic matter.

Analytical Indicators & Requirements:

- Discussion of site-specific soil conditions and baseline inventory of soil organic matter.
- Area (acres) of temporary and permanent disturbance according to high/moderate/low erodibility soils classes.
- Analysis of increased erosion hazard due to ground disturbance.
- Analysis of slope stability and geological constraints associated with project components.

Watershed and Wetlands

Issue: Proposed ground disturbance (e.g., clearing, grading, and culverting Westfall Creek) and additional snowmaking may contribute sediment and reduce stream bank stability in Beaver Creek and affect riparian habitat, wetlands and fisheries.

Issue: Project activities may cause changes in surface and groundwater hydrology that support streams and wetlands.

Issue: Additional snowmaking water use may impact the following: in-stream flows; aquatic habitat through diversion; and water yield. It also may exacerbate drainage problems within the project area.

Issue: Proposed ground disturbance (e.g., clearing, grading, and culverting Westfall Creek) may affect the quantity of wetlands within the Study Area.

Analytical Indicators & Requirements:

- Identification/quantification of waters of the U.S., including wetlands in the vicinity of the project area.
- Identification of any Clean Water Act (CWA) impaired or threatened waterbody segments in the project area.
- Quantification of existing and proposed water depletions (acre feet [AF]) for snowmaking under all alternatives.
- Discussion of the quality of water used for snowmaking, and an assessment of the water quality of receiving water bodies.
- Quantification of connected disturbed areas (CDA) in the vicinity of the project area.
- Quantification of total consumptive water losses (i.e., evaporation, evapotranspiration, sublimation) resulting from existing and proposed snowmaking.

- Identification of clearing and grading in the Water Influence Zone (WIZ).
- Quantification of changes in water yield or discharge to receiving streams from proposed snowmaking and grading.
- Narrative description of affects to wetland functions and values.

H. SCOPE OF THE ANALYSIS

Scope consists of the range of actions, alternatives, and impacts to be considered within this FEIS. Furthermore, it includes the spatial and temporal boundaries associated with the actions, alternatives, and impacts. Individual project elements that compose the Proposed Action are discussed in detail in Chapter 2, and are illustrated in associated figures. The scope of this environmental analysis and the study area varies by resource. Therefore, the scope of analysis and study area are presented at the beginning of each resource section in Chapter 3. This FEIS analyzes direct, indirect and cumulative impacts on a resource-by-resource basis.

The Purpose and Need for Action, and therefore the Proposed Action, analyzed in this FEIS primarily focuses on Alpine racing events, which are essentially short-duration, annual events. These include, but are not necessarily limited to, annual World Cup races and the upcoming 2015 World Alpine Ski Championships. Annual World Cup events are held over a period of three days in the early season (early December) while the 2015 World Alpine Ski Championships are planned over a two-week period in February 2015. All racing events include additional time for course preparation and breakdown. Therefore, the scope of the environmental analysis in this FEIS is considerably different for resources that can be grouped into the “human” versus “biological” environments. Effects to resources that are within the human environment (e.g., recreation, traffic, social and economic resources) are more-or-less short-term—related to a racing event. Effects to the biological environment (i.e., wildlife and botanical resources, hydrology, etc.) are considered more-or-less long-term, and are analyzed as such.

I. CONSISTENCY WITH FOREST SERVICE POLICY

LAND AND RESOURCE MANAGEMENT PLAN CONSISTENCY

Beaver Creek’s SUP boundary was amended in 2002 when the WRNF’s Land and Resource Management Plan was revised. The current SUP area includes 3,849 acres of NFS lands. Therefore, Beaver Creek’s operations carried out on NFS lands must comply with management direction provided in the 2002 Forest Plan. The 2002 Forest Plan includes 33 separate Management Areas for different portions of the forest based on ecological conditions, historic development, and anticipated future conditions. All components of the Proposed Action fall within the 8.25 Management Area – Ski Areas (Existing and Potential), which directs:

“Facilities may be intensively used throughout the year to satisfy a variety of seasonal recreational demands... Protection of scenic values is emphasized through application of basic landscape aesthetics and design principles, integrated with forest management and development objectives... Transportation systems provide convenient access to National Forest System lands in key portal locations with adequate public parking, base facilities, and community infrastructure. Base areas that serve as entrance portals are designed as gateways to public lands. They are architecturally designed to blend with the forest setting and contain convenient facilities and services that provide for the needs of forest visitors.”⁴

As part of this analysis, the Alternatives and Purpose and Need were reviewed to determine consistency with the Forest-wide Goals and Objectives as well as the specific Standards and Guidelines for Management Area 8.25. The 2008 Southern Rockies Lynx Management Direction (SRLMD) amended the 2002 Forest Plan with respect to Forest-wide and Management Area 8.25 Canada lynx standards and guidelines. The action alternative was compared against pertinent Forest-wide and Management Area standards and guidelines; no inconsistencies between the proposal and pertinent standards and guidelines were identified.

The Purpose and Need is consistent with the 2002 Forest Plan General Recreation Standards and Guidelines. The 2002 Forest Plan acknowledges an increasing demand for recreation on the WRNF, and states:

“Satisfy demand for recreation services that are supplied by private-sector permittees at authorized sites or areas before new sites or areas are permitted.”⁵

The theme of Management Area 8.25 is discussed in the 2002 Forest Plan and states:

“Ski areas are developed and operated by the private sector to provide opportunities for intensively managed outdoor recreation activities during all seasons of the year. This management area also includes areas with potential for future development.”⁶

J. DECISION TO BE MADE

Based on preliminary internal Forest Service analysis and external public scoping, and evaluation of the context and intensity factors contained in 36 CFR 1508.27, the Forest Service determined early on that an EIS is appropriate to review, analyze, and document the potential impacts to the human and biological environment anticipated to result with the implementation of the proposed projects. This FEIS is a

⁴ USDA Forest Service, 2002c p. 3-80

⁵ USDA Forest Service, 2002a p. 2-31

⁶ Ibid. p. 3-80

disclosure rather than a decision document and its purpose is to provide sufficient environmental analysis to support a Record of Decision (ROD), which will be released in conjunction with a Final EIS.

Based on the analysis documented within this FEIS, the responsible official—the Forest Supervisor for the WRNF—will decide whether to select Alternative 2 (Proposed Action) or the No Action Alternative. The Forest Supervisor is not required to choose either the Proposed Action or the No Action Alternative described herein, but may select components of each. In addition to determining which alternative to select, the Forest Supervisor will also determine which Project Design Features (PDF), mitigation measures, and best management practices (BMPs) to require. The Forest Supervisor may also require additional PDF, mitigation measures, and/or BMPs not discussed within this document.

In compliance with Forest Service Handbook 1909.15 chapter 18, the Forest Service will continually review the relevancy of the analysis and subsequent decision for new and changed conditions as any approved projects are advanced for implementation.

K. OTHER NECESSARY PERMITS, LICENSES, ENTITLEMENTS AND/OR CONSULTATION⁷

The Forest Service decision would apply only to NFS lands analyzed within this FEIS. However, other federal, state, and local entities may also have jurisdiction. Decisions by jurisdictions to issue or not issue approvals related to this proposal may be aided by the analyses presented in this FEIS. While the Forest Service assumes no responsibility for enforcing laws, regulations, or policies under the jurisdiction of other governmental agencies, Forest Service regulations require permittees to abide by applicable laws and conditions imposed by other jurisdictions. In addition to requisite Forest Service approvals, consultation with the following entities, or permits, may be required to implement any approved projects:

- U.S. Fish and Wildlife Service (USFWS), Endangered Species Act (ESA) Section 7 Consultation
- Comply with Colorado Department of Public Health and Environment Stormwater Construction Activities Permit
- Eagle County General Construction Permit

⁷ Per 40 CFR 1502.25(b)

Chapter 2

Description of Alternatives

2. DESCRIPTION OF ALTERNATIVES

A. INTRODUCTION

Chapter 2 describes the alternatives considered within this environmental analysis and briefly summarizes the environmental consequences anticipated to result with the implementation of each. As required by the Council on Environmental Quality (CEQ), the alternatives considered are presented in comparative form.⁸ Project Design Features (PDF) and Best Management Practices (BMPs), designed to lessen or avoid impacts anticipated to occur as a result of implementation of the any of the action alternatives, are also detailed.

NEPA requires that an environmental analysis examine a range of alternatives, which are reasonably related to the purpose of the project.⁹ Both CEQ Regulations and Forest Service Handbook direction emphasize that alternatives must meet the “reasonableness” criteria in order to warrant detailed analysis. Alternatives and project components which were considered within the analysis process, but were determined not reasonable, were eliminated from detailed study with a brief discussion of the rationale for their elimination.¹⁰

The issues raised during the scoping process (detailed in Chapter 1) were utilized as the basis for determining the need for additional alternatives to the Proposed Action.

B. ALTERNATIVES CONSIDERED IN DETAIL

ALTERNATIVE 1 – NO ACTION

As required by NEPA, a No Action Alternative has been included in this analysis for review alongside the Proposed Action.¹¹ By definition, the No Action Alternative represents a continuation of existing management practices without changes, additions, or upgrades to existing conditions.

Under the No Action Alternative, Beaver Creek would continue to host the only men’s World Cup skiing event in the United States. Due to a lack of suitable terrain to host the women’s Downhill, Giant Slalom or Super G, it would not be possible for Beaver Creek to host these women’s events.

Red Tail Camp would continue to provide guest services at the finish area of the *Birds of Prey* racecourse, although seating capacity would remain at 475 seats (269 indoor + 206 outdoor). The existing TV/Media compound located on the southwestern portion of Red Tail Camp would not be expanded under the No

⁸ 40 CFR 1502

⁹ FSH 1909.15, Chapter 10, Section 12.33

¹⁰ 40 CFR 1502.14(a)

¹¹ 40 CFR 1502.14

Action Alternative. Although adequate water is currently available for existing on-mountain guest service facilities, new codes could require additional water for fire flows in the future.

ALTERNATIVE 2 – THE PROPOSED ACTION

Goals and objectives for the resort, and specific projects that were designed to meet those goals and objectives, are identified in Beaver Creek’s 2010 MDP Update.¹² Specific projects included in Alternative 2 – the Proposed Action were designed to meet the four elements of the Purpose and Need (detailed in Chapter 1), which are:

1. Improve upon/expand terrain to meet FIS requirements for both men’s and women’s Alpine race events.
2. Provide a racecourse finish area that meets FIS requirements for larger Alpine race events.
3. Improve on-mountain guest services to accommodate the general public throughout the year and during Alpine race events.
4. Respond to key infrastructural deficiencies related to race storage, water delivery, and wastewater.

While the short-term goal of the Proposed Action is to enable Beaver Creek to host the upcoming 2015 World Alpine Ski Championships, implementation of these projects would respond to a key goal and objective of the 2010 MDP Update to: “update mountain facilities and infrastructure related to ski racing and continue to provide world class venues for Alpine events.” This is proposed to be accomplished by capitalizing on, and improving upon, existing training and race terrain, and adding on-mountain guest services and snowmaking facilities. All proposed projects are within Beaver Creek’s SUP area (with the exception of a proposed sewer line that extends north of the SUP area on private land) and are within its existing lift/terrain network.

The reader is encouraged to reference Figure 2 in conjunction with the following project descriptions.

Terrain Projects

Specific terrain projects are proposed within the Birds of Prey pod and on Grouse Mountain that would enable Beaver Creek to host women’s Downhill and Giant Slalom races, and would address technical issues with the existing men’s *Birds of Prey* racecourse.¹³ Note that, as is the case with the existing *Birds of Prey* racecourse, the proposed women’s racecourses would be created by linking together segments of numerous individual trails (primarily existing and some proposed). All projects are designed to meet FIS requirements.¹⁴

¹² Beaver Creek Resort, 2010 p. 7

¹³ “Pod” is defined as a lift and the terrain in which it is generally.

¹⁴ Note: for safety and operational reasons (all racecourses terminate at Red Tail Camp), it would not be possible to have separate races run concurrently (i.e., only one racecourse could be in operation at a time).

Individual projects related to the men's and women's Downhill courses, and the women's Giant Slalom course, are discussed separately below.

Birds of Prey Women's Downhill Course

The women's Downhill course is proposed to be constructed within the Birds of Prey pod, utilizing *Flattops*, *Peregrine* and two new trail segments. Approximately 4.6 acres of grading and 15.6 acres of overstory vegetation removal/grading would be necessary to construct the proposed women's Downhill racecourse. Specific proposed projects include:

- Trail widening and tree island removal on *Flattops* above the Birds of Prey Express (to accommodate the race starting area and the first segment of the racecourse)
- New snowmaking infrastructure on upper *Flattops*
- Replacement of existing snowmaking infrastructure on *Peregrine*
- Trail widening and tree clearing on *Peregrine*
- Tree removal and stumping/smoothing to create two new trail segments
- Snowmaking infrastructure installation on the two new trail segments¹⁵

Grouse Mountain Women's Giant Slalom Course

The women's Giant Slalom racecourse is proposed on Grouse Mountain, and would utilize *Raven Ridge*, lower *Golden Eagle*, and a short new section of connector trail. Approximately 0.6 acre of grading and 1.7 acres of vegetation removal/grading would be necessary for the proposed women's Giant Slalom racecourse. Specific proposed projects include:

- Trail widening and tree removal on upper *Raven Ridge*
- Trail widening and tree removal to create a connection between *Raven Ridge* and lower *Golden Eagle*
- Snowmaking infrastructure upgrading on *Raven Ridge* (requires additional hydrants)

Birds of Prey Men's Downhill Course

Specific projects are proposed to accommodate technical issues on the existing men's *Birds of Prey* racecourse. These projects would entail approximately 10 acres of grading and 0.8 acre of overstory vegetation removal/grading. Specific proposed projects include:

- Trail widening just above *Westfall Road*

¹⁵ Additional snowmaking water that would be applied to the proposed racecourses is within Beaver Creek's existing water rights.

- Re-grading at specific points along *Zoom Room* and *Golden Eagle* (see Figure 2) that would reduce the amount of snow that is necessary to prepare the *Birds of Prey* racecourse in compliance with FIS standards

Spectator Access

The proposed women's Downhill racecourse safety nets would render the existing spectator access route to the men's *Birds of Prey* racecourse unusable. Therefore, existing on-course spectator access is proposed to be modified to accommodate both the men's and women's Downhill racecourses, which would be parallel to one another. In addition, skier access to Red Tail Camp during Alpine racing events is proposed to be enhanced. Proposed projects include:

- A new access trail from *Goshawk* to *Peregrine* would enable event spectators descending from the Cinch Express to reach the middle portion of both the men's and women's Downhill racecourses. In order to access the Men's Downhill course, spectators would need to cross the Women's Downhill course. This would entail approximately 1.3 acres of disturbance and overstory vegetation removal.
- An existing utility corridor would be widened between the *Dally* catwalk and Red Tail Camp to improve skier/rider circulation when visitors descend from the top of the Centennial Express (this would entail approximately 2.2. acres of disturbance). Snowmaking is proposed on this area.

Red Tail Camp/Racecourse Finish Area

The entire Red Tail Camp area is proposed to be re-graded and re-configured to accommodate a larger finish area that can be used for men's and women's Alpine racing events. Approximately 6.9 acres of this area are proposed to be re-graded and 0.3 acre is proposed for overstory vegetation removal/grading. Proposed projects in the Red Tail Camp finish area include:

- Remove and replace the existing Red Tail Camp guest service facility with a larger building (approximately 25,000 square feet). The seating capacity would increase from 475 seats to roughly 600 indoor/160 outdoor seats.
- Replace and realign the culverted portion of Westfall Creek that runs through the Red Tail Camp area.
- Culvert an approximately 150-foot long stretch of Westfall Creek (currently not culverted) that runs through the Red Tail Camp area. In order to comply with Forest Service Handbook direction for Region 2 to only allow those actions that "maintain or improve" watershed conditions, an existing culvert on *Peregrine* (above *Red Tail*) would be removed to mitigate for the additional culverted portion of Westfall Creek.

- Relocate existing utility lines (including water, sewer, electrical, snowmaking, gas, phone and fiber optic).
- Expand the TV compound by approximately 75 percent (approximately 10,000 square feet) to accommodate current and future media needs associated with Alpine racing events. In order to avoid wetland impacts the TV Compound could be expanded onto the existing bus drop off/turnaround. This would require the relocation of the bus drop-off/turnaround to be located closer to Red Tail Camp, which would have the added benefit of eliminating the need for spectators to walk up the Dally Road to get to the Finish Stadium.

Infrastructure Projects

The following infrastructure projects are proposed to better meet Beaver Creek's existing and future operational needs related to Alpine ski racing and general mountain operations. These proposed projects would entail approximately 8 acres of grading and 0.5 acre of overstory vegetation removal/grading.

Race Storage

- Install a 24 x 36-foot storage facility west of the top terminal of the Birds of Prey Express.

Water Tank

- Construct a new 150,000-gallon water tank and pump station on the edge of *Paint Brush*, adjacent the *Beaver Creek Expressway*. In addition to providing additional potable water for the larger Red Tail Camp facility, this would provide additional water for fire suppression and an enhanced distribution system.

Utilities

- Install a new 2,900-foot water line from the proposed 150,000-gallon water tank to the existing water line in the Red Tail Camp area. An underground submersible inline pump station would be installed at the top of the utility corridor.
- Upgrade the approximately 1,400-foot existing 4-inch domestic water line between Beano's Cabin and Red Tail Camp to an 8-inch water line.
- Replace approximately 3,000 feet of new sewer line from Red Tail Camp down *Dally*.

C. ALTERNATIVES AND DESIGN COMPONENTS CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

One alternative to the Proposed Action was considered by the ID Team. This alternative would have limited grading on the new trails proposed in conjunction with racecourses. This concept would have included flush-cutting stumps to ground level, as opposed to stumping/smoothing that is included in the Proposed Action. This concept was considered in order to minimize impacts to soils, hydrology, wetlands

and botany that are associated with stumping/smoothing. This concept was not considered for detailed analysis in the Draft or Final EIS for two primary reasons:

1. Retaining stumps on trails that are proposed for use as racecourses presents operational and safety issues—primarily related to natural and man-made snow coverage. Due to the potential for the 2015 World Alpine Ski Championships to be held at Beaver Creek, ensuring adequate snow coverage is essential.
2. The theme of MA 8.25 is intensively managed outdoor recreation activities during all seasons of the year.¹⁶ As such, removing stumps, in conjunction with grading and snowmaking, for construction of racecourses at Beaver Creek is consistent with this management area direction.

D. PROJECT DESIGN FEATURES INCORPORATED INTO ALTERNATIVE 2

In order to minimize potential resource impacts from construction and implementation of any approved projects, Project Design Features (PDF) have been incorporated into Alternative 2.

PDF are devised in the pre-analysis and analysis phases to reduce environmental impacts that must be complied with by law and/or regulation. They include, but are not limited to, BMPs, standards and guidelines, and standard operating procedures.

PDF were designed by the Forest Service and specialists involved in this analysis. The potential effects of implementing the Proposed Action (provided in Chapter 3) were analyzed with these PDF applied.

PDF come from federal, state, and local laws, regulations and policies, forest plans, scientific research, and from experience in designing similar projects. The bulk of the PDF are considered common practices that ski area managers have historically used in alpine and sub-alpine environments to prevent or decrease potential resource impacts. They are highly effective methods that can be planned in advance and adapted to site conditions, as needed.

Responsibility for ensuring that required PDF are implemented rests with Beaver Creek and the Forest Service. In all cases, the ultimate enforcement mechanism for implementation of the specified PDF would be the Record of Decision, and would extend from the Forest Supervisor to the District Ranger, to the Forest Service SUP Administrator.

¹⁶ USDA Forest Service, 2002 p. 3-80

**Table 2-1:
Project Design Features and Best Management Practices**

RECREATION
During construction, notices will be placed on trailheads and in Beaver Creek Village informing users of the summer recreational trail system of temporary trail closures and the location of construction activities.
PARKING AND TRAFFIC
Beaver Creek will continue to coordinate with the Town of Avon and State police in regards to anticipated high attendance days.
On event days in which high volumes of vehicles are anticipated, electronic signs will be used to direct arriving vehicles to available parking lots, Highway 6, or to other offsite parking areas.
On event days in which high volumes of vehicles are anticipated, parking attendants will be used to direct arriving vehicles to available parking facilities.
SCENIC RESOURCES
For the proposed Red Tail Camp facility, follow FSM guidelines (Section 2380) and Built Environment Image Guide (BEIG) guidelines: <ul style="list-style-type: none"> • The scenic character will be protected through appropriate siting of buildings and the use of low-impact materials and colors (e.g., indigenous construction materials, such as stone and wood, as well as low-reflective glass and roofing materials). • Remain in context with the landscape (i.e., rustic, craftsman, and country lodge styles).
Structures will be constructed of materials which blend with the landscape character, as is practicable, and shall meet FSM 2380 policy for color and reflectivity, which is 4.5 on the Munsell neutral value color scale. Building designs will be submitted to the Forest Service for review and approval.
To the extent possible, and consistent with the intent of proposed projects for Alpine ski racing, site grading should blend disturbance into the existing topography to achieve a natural appearance and minimize cuts and fills at the transition with proposed grading and existing terrain.
Utilities must be buried.
All disturbed areas shall be promptly revegetated after the site has been satisfactorily prepared.
All proposed facilities need to meet reflectivity guidelines. This includes any reflective surfaces (metal, glass, plastics, or other materials with smooth surfaces), that do not blend with the natural environment. They should be covered, painted, stained, chemically treated, etched, sandblasted, corrugated, or otherwise treated to meet the solar reflectivity standards.
All proposed facilities need to meet color guidelines. Bright colors are inappropriate for the forest setting. The colors should be muted, subdued colors because they blend well with the natural color scheme. The Forest Service Handbook No. 617, "National Forest Landscape Management for Ski Areas, Volume 2, Chapter 7," refers recommended colors for ski areas on page 37 of that handbook. The colors are darker colors; greens, browns, navy blue, grays and black.
CULTURAL AND HERITAGE RESOURCES
Although site-specific surveys have been conducted, if undocumented historic and/or prehistoric properties are located during ground disturbing activities or planning activities associated with approved construction activities, they would be treated as specified in 36 CFR 800.11 concerning Properties Discovered During Implementation of an Undertaking.

**Table 2-1:
Project Design Features and Best Management Practices**

AIR QUALITY
To the extent practicable, site improvements would be installed promptly in order to reduce the potential for dust emissions. The area disturbed by clearing, earth moving, or excavation activities would be kept to a minimum at all times, allowing improvements to be implemented in sections.
Graded areas would be watered as necessary and practical to prevent excessive amounts of dust.
During project implementation, equipment idling time and construction-related trips will be minimized, as appropriate.
Construction equipment engines will be maintained.
Burning of slash/timber will be staged to reduce the volume of smoke being produced at any one time.
Non-agricultural material will not be included in burn piles.
Slash treatments that may be considered include piling and burning, chipping, lopping and scattering or mechanical treatment on slopes less than 40 percent.
Machine piles shall be located in clearings to minimize damage to the canopy of residual trees during burning operations. Piles need to be constructed free of dirt to facilitate consumption during burning. Pile size shall comply with the latest direction from the Colorado Air Pollution Control Division (APCD).
Slash piles will only be burned when there is greater than 3 inches of snow on the ground.
Prescribed burning must be planned and executed in coordination with the appropriate local jurisdictions, the Forest Service, and the APCD.
Construction vehicles will utilize low sulfur or alternative fuels during project implementation.
During project implementation, equipment idling time and construction related trips will be minimized.
To minimize traffic contributions (and therefore emissions) directly related to the 2015 World Alpine Skiing Championships, additional measures will be developed in coordination with Beaver Creek to promote strategies to reduce vehicle use. This may include the availability of additional vans or buses owned and operated by Vail Resorts, Inc.
WILDLIFE
During construction, a bear proof container will be provided on site for all edible and food related trash in order to minimize conflicts with black bears. No food products or food containers can be thrown in the larger roll-off type dumpsters.
All construction activities should be confined to daylight hours, excluding emergencies.
Construction workers are prohibited from bringing dogs to the construction site.
If boreal owl nests are detected within the project area, direct mortality of eggs and/or nestlings could be avoided by conducting tree removal in potential nesting habitat outside of the May 21 to July 15 nesting (with eggs/young) period.
If three-toed woodpecker nests are detected within the project area, direct mortality of current year recruitment could be avoided by conducting tree removal in potential nesting habitat outside of the March 14 to July 15 nesting period.
If olive-sided flycatcher nests are detected within the project area, direct mortality of eggs and/or nestlings could be avoided by conducting tree removal in potential nesting habitat outside of the June 1 and July 15 nesting period.
If American marten dens are detected within the project area, direct mortality of current year recruitment could be avoided by conducting tree removal in potential denning habitat outside of the March 1 to June 15 period.

**Table 2-1:
Project Design Features and Best Management Practices**

To protect any fish eggs and spawning gravels that might be present in or downstream, work on stream crossings and ground disturbance areas approaching the Water Influence Zone (WIZ) on Westfall Creek should occur during the low flow period between August 1 and September 31.
To minimize traffic contributions directly related to the 2015 World Alpine Skiing Championships, and reduce vehicle trips through the lynx linkage areas, additional measures will be developed in coordination with Beaver Creek to promote strategies to reduce vehicle use. This may include the availability of additional vans or buses owned and operated by Vail Resorts, Inc.
VEGETATION
Seed mixtures and mulches will be noxious weed-free. To prevent soil erosion, non-persistent, non-native perennials or sterile perennials may be used while native perennials become established. The Forest Service must approve the seed mixtures prior to implementation, unless previously approved seed mixes are employed
Apply effective ground cover (mulch) upon completion of ground disturbing activities that would meet minimum level of the pre-treatment habitat type.
Tree clearing limits will be adequately marked to minimize mistakes in clearing limits during construction.
Vegetative buffers will be maintained adjacent to intermittent or perennial drainages and wetlands, to the extent possible. Where avoidance is not possible, impacts would be minimized in sensitive areas. Hand-felling should occur where necessary and feasible.
In all areas where grading or soil disturbance will occur, topsoil or other organic amendment would be stockpiled and re-spread following slope grading and prior to re-seeding where possible/practical
Soil-disturbing activities will be avoided during periods of heavy rain, runoff or wet soils.
Areas determined to have been compacted by construction activities may require mechanical subsoiling or scarification to the compacted depth to reduce bulk density and restore porosity.
Ground cover, as a combination of revegetation and mulch applications, should meet requirements for the one and two years following completion of ground disturbing activities.
A re-vegetation plan will be prepared, including measures to adequately establish desirable vegetation.
Any Engelmann spruce that is felled must be either removed from the area or treated within one year after felling to prevent the buildup of spruce bark beetle. Treatments can include burning, burying or peeling the bark off felled Engelmann spruce.
Any loss of riparian vegetation caused by construction activities should be re-vegetated immediately after construction with native vegetation, willow cuttings, and/or native, certified, weed free seed.
Surface netting in conjunction with mulching will be used to reduce the erosion hazard.
Vegetative buffers will be maintained adjacent to intermittent or perennial drainages and wetlands, to the extent possible. Where avoidance is not possible, impacts would be minimized in sensitive areas. Hand-felling should occur where necessary and feasible.
Populations/aggregations of R2 sensitive plants and SOLC identified within the proposed disturbance area should be avoided to the extent possible.
NOXIOUS WEEDS
Clean construction equipment prior to entry onto NFS land.
Treat travel routes accessing the project area prior to and during project construction. Travel routes include ski area access roads, after leaving county administered roads.

**Table 2-1:
Project Design Features and Best Management Practices**

Monitor and treat any existing or new infestations for a minimum of three years after project completion.
SOILS
Prior to construction, a detailed site erosion control plan will be prepared. This plan shall include the following components: <ul style="list-style-type: none">• Silt fences, straw bales, straw wattles, and other standard erosion control BMPs shall be employed to contain sediment onsite.• Jute-netting or appropriate erosion-control matting on steep fill slopes (i.e., land with a slope angle of 35% or greater) to protect soils and enhance conditions for vegetation re-establishment.
Promptly revegetate disturbed areas.
Existing roads will be used for construction and routine maintenance of the proposed project components where possible.
Vegetative buffers will be maintained adjacent to intermittent or perennial drainages and wetlands, to the extent possible. Where avoidance is not possible, impacts will be minimized in sensitive areas.
In all areas where grading or soil disturbance will occur, a reassessment of the quantity (depths) of soil A and/or organic ground cover would be made to ensure no net loss of this material.
Soil-disturbing activities will be avoided during periods of heavy rain or wet soils.
Areas determined to have been compacted by construction activities may require mechanical subsoiling or scarification to the compacted depth to reduce bulk density and restore porosity.
Ground cover, as a combination of revegetation and mulch applications, should meet requirements for the one and two years following completion of ground disturbing activities.
WATERSHED AND AQUATIC RESOURCES
Design features and management practices specific to the Westfall Creek watershed: <ul style="list-style-type: none">• Water bars must be designed and constructed to discharge surface runoff originating within the proposed and improved ski trails away from the WIZ and into well vegetated areas.• Install BMPs that encourage sediment separation and dispersion of flow, such as straw bales and fiber logs, at discharge points along roadside ditches. This is particularly important when the ditches discharge flow within 200 feet of stream channels.• Fell trees into the intertrail islands that exist within the WIZ to improve LWD density. In addition, scatter cut branches on trails or pile along the edge of ski runs.• Where practical, discourage guests from skiing the interior of intertrail islands in the WIZ to promote maximum vegetative growth in the riparian areas.• Prior to construction, a field survey of the site will be conducted to identify and flag sensitive wetland areas to avoid impacts.• Identify and reclaim areas where vegetation could be re-established, particularly in the WIZ.• Disconnect a minimum of 1.4 acres of graded connected ski trails currently existing in close proximity to Westfall Creek. This could be achieved by construction of water bars in the Golden Eagle trail that direct and discharge surface runoff away from the creek's WIZ. This measure would off-set the proposed impacts and be consistent with WCPH Design Criteria.

**Table 2-1:
Project Design Features and Best Management Practices**

<p>Design features and management practices specific to the Beaver Creek watershed:</p> <ul style="list-style-type: none"> • Prior to construction, a field survey of the site will be conducted to identify and flag sensitive wetland areas to avoid impacts. • When accessing the project location, crews should remain on established routes, and wherever possible, confine activities to existing trails. • Avoid soil-disturbing actions during periods of heavy rain or wet soils. • Straw bales should be installed up-gradient of open trench and disturbed soils to minimize introduction of off-site runoff into the trench corridor. • Silt fence and straw-baling where appropriate for steeper areas, properly entrenched, should be installed down-gradient of the trench to minimize potential sediment transport from disturbed soils. Eliminate any connection from disturbed areas to proximal wetlands, waterways, or drainages. • The top 6 inches of topsoil should be stockpiled, where possible, and re-used during re-vegetation after completion of pipeline emplacement. • Re-vegetation should commence within five days of completion of ground disturbing activities. The disturbed areas should be mulched and fertilized utilizing USFS certified seed mix and mulch. • Design, construct, and maintain the improvement of the <i>Dally</i> catwalk to drain naturally by insloping the road to the ditch. Discharge roadside ditch flow away from Westfall Creek and into well vegetated areas.
<p>Design features and management practices specific to the 285-foot section of new stream that would be designed and constructed to convey a reach of Westfall Creek that is currently piped under <i>Peregrine</i>:</p> <ul style="list-style-type: none"> • The new channel substrate will be composed of native material of similar size distribution to those present in Westfall Creek just above the proposed mitigation site. • The step-pool bedforms will be formed with key pieces properly sized and anchored in order to sustain the 100-year flood event. • The channel slope, dimensions, and hydraulic characteristics will be designed to maintain adequate sediment transport capability throughout the entire length of the mitigated channel. • Streambanks on the proposed channel will be vegetated with shrubs and willows transplanted from the riparian vegetation existing in Westfall Creek above and/or below the proposed mitigation site. • The existing 42-inch corrugated metal pipe culvert will be left in place in order to convey a portion of the seasonal Westfall Creek high flows to prevent damage to the constructed channel and growing riparian vegetation. Once the restored stream channel has stabilized, the 42-inch culvert may be removed. • Construction will occur during low flow conditions, as directed by WRNF hydrologists. • A construction erosion control plan will be developed for review and approval by WRNF personnel.
<p>Connected disturbed areas should be mitigated, and additional sediment controls that could result in improved stream health may be implemented concurrently with on-mountain construction (this may be necessary for the project to be in compliance with Watershed Conservation Practices Handbook).</p>

**Table 2-1:
Project Design Features and Best Management Practices**

Prior to approved construction activities on NFS lands, Beaver Creek will prepare the following plans for Forest Service approval: <ol style="list-style-type: none">1. Grading2. Erosion control3. Pre-construction erosion control/drainage management plans4. Post-construction revegetation plans5. Engineered channel design
Before grading, existing topsoil resources will be removed where possible, either by machine or by hand, and stockpiled in an area where soils storage will not cause a resource impact. Subsequent to the grading activities, this topsoil or other organic amendment will be re-spread, mulched and re-seeded for use in the final restoration of the site.
Soil-disturbing activities will be avoided during periods of heavy rain or wet soils.
Keep heavy equipment out of streams, except to cross at designated points, build crossings, or do restoration or culvert work.
Water bars must be designed and constructed to discharge surface runoff originating within proposed ski trails away from the WIZ and into well vegetated areas, effectively disconnecting disturbed areas from the stream channel.
When appropriate, the downstream end of water bars will encourage sediment separation and dispersion of flow by using straw bales and fiber logs or other appropriate management at discharge points.
Erosion control measures such as water bars must be constructed immediately after construction of new trails; inspect water bars during the first snowmelt period following construction.
Immediately following completion of approved ground disturbing activities and seeding, all areas of ground disturbance will be mulched with weed-free straw, wood chips, bark, jute mat, etc.
Where construction crosses a stream channel the channel will be routed through a flexible hose around the area of disturbance. To protect the channel from scour where the water is reintroduced to the stream, temporarily place rocks in the channel.
Fuel, oil and other hazardous materials will be stored in structures placed on impermeable surfaces with impermeable berms designed to fully contain the hazardous material plus accumulated precipitation for a period at least equal to that required to mitigate a spill.
WETLANDS
Construction spoils will be temporarily placed in upland areas in locations that will not migrate to wetland areas.
Work within stream channels and wetlands will be completed when hydrologic flows are reduced.
BMPs will be applied for all ground disturbing activities to avoid sediment migration from ground disturbance into wetlands.
Wetlands proximate to potentially disturbed areas would be identified and flagged prior to the initiation of approved construction related activities. Construction limits will be clearly defined and any identified wetlands would be avoided where possible.
Appropriate high altitude wetland seed species will be used to revegetate wetlands as soon as possible after the disturbance.
Construction and project design will preclude drainage of adjacent wetlands.

Chapter 3

Affected Environment and Environmental Consequences

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

CEQ regulations direct agencies to succinctly describe the environment that may be affected by the alternatives under consideration.¹⁸ As such, Chapter 3 describes the existing physical, biological, social, and economic components of the project area which have potential to be affected by implementing any of the alternatives (i.e., the Affected Environment). Each Affected Environment description is followed by an Environmental Consequences discussion that provides an analysis of the potential effects of implementation of each of the alternatives.

Chapter 3 is organized by resource area, and follows the organization of issues and resources requiring further analysis (and indicators) as presented in Chapter 1. Each resource section in Chapter 3 is organized in the following order:

SCOPE OF THE ANALYSIS

The scope of the analysis briefly describes the geographic area(s) potentially affected by the alternatives for each issue and its indicator(s). The scope of analysis varies according to resource area and may be different for direct, indirect, and cumulative effects. Note that, due to the unique nature of the Proposed Action (by-and-large focused on hosting international Alpine skiing events—including, but not necessarily limited to, the 2015 World Alpine Ski Championships) the scope of the environmental analysis is considerably different for human and biological resources.

AFFECTED ENVIRONMENT

The Affected Environment section provides a description of the environment potentially affected, as based upon current uses and management activities/decisions.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

This section provides an analysis of direct and indirect environmental effects of implementing each of the alternatives, according to the issues or resources requiring additional analysis and indicators identified in Chapter 1. Cumulative effects are discussed separately.

Direct effects are caused by the action and occur at the same time and place. Indirect effects are caused by the action and occur later in time or are farther removed in distance, but are still reasonably foreseeable (i.e., likely to occur within the duration of the project).

¹⁸ 40 CFR 1502.15

CUMULATIVE EFFECTS

Cumulative effects are the result of the incremental direct and indirect effects of any action when added to other past, present, and reasonably foreseeable future actions, and can result from individually minor but collectively major actions taking place over a period of time.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

An irreversible commitment is a permanent or essentially permanent use or loss of resources; it cannot be reversed, except in the extreme long term. Examples include minerals that have been extracted or soil productivity that has been lost. An irretrievable commitment is a loss of production or use of resources for a period of time. One example is the use of timber land for a logging road. Timber growth on the land is irretrievably lost while the land is a road, but the timber resource is not irreversibly lost because the land could grow trees in the near future. The Forest Service recognizes the fact that certain management activities will produce irreversible or irretrievable commitments of resources.

A. RECREATION

SCOPE OF THE ANALYSIS

This analysis addresses recreational opportunities available at Beaver Creek. The majority of Beaver Creek's on-mountain operations are conducted on public lands administered by the WRNF. The scope of this analysis is specific to areas within the SUP boundary that have potential to be affected by proposed projects, including the Birds of Prey and Grouse Mountain pods (i.e., the Upper Mountain). On-mountain guest services, as they relate to proposed projects, are also discussed.

AFFECTED ENVIRONMENT

Resort Capacity

Two planning concepts are used at Beaver Creek to address the resort's capacity: "Manage-To" and "Comfortable Carrying Capacity."

The "Manage-To" process allows Beaver Creek and the Forest Service to manage for health, safety and welfare considerations, and a high quality skier experience based on calculated planning numbers (a threshold). Manage-To is a flexible process used by Beaver Creek when skier numbers exceed an agreed-upon threshold. Manage-To includes steps to manage skier numbers on subsequent days if it is likely that skier numbers may again exceed the threshold.¹⁸ Beaver Creek's current Manage-To number is 13,000 skiers-at-one-time.

As opposed to Manage-To, Comfortable Carrying Capacity ("CCC") is a planning tool used to determine the optimum level of daily utilization for a resort—one that facilitates a pleasant recreational experience. This is a planning figure only and does not represent a regulatory cap, or threshold, on visitation. CCC is used to ensure that capacities are balanced across facilities and are sufficient to meet anticipated demand. CCC is based on a comparison of uphill vertical lift supply (i.e., lift capacity) to downhill vertical skiing demand. The calculated CCC of the lift and trail network at Beaver Creek is 15,320 guests per day.

The fact that the capacity of Beaver Creek's lift and trail network (CCC) is considerably higher than its Manage-To threshold is beneficial to the recreational experience of Beaver Creek's guests. This demonstrates that Beaver Creek actively manages its daily visitation levels to keep lift lines short and trail densities low.

Lift and Terrain Network

Beaver Creek operates under a Forest Service 40-year SUP covering approximately 3,849 acres of the WRNF. There are approximately 1,570 acres of formalized lift-served terrain within the total resort area,

¹⁸ Beaver Creek Resort, 2010 p. 11

including the SUP (965 acres) and private land area (605 acres). There are 148 named trails, and approximately 774 acres of named and unnamed glades throughout the resort, for a total skiable acreage of approximately 2,344 acres. The formalized ski trail network accommodates the entire range of skier ability levels from beginner to expert. Beaver Creek has 23 lifts, ranging from gondolas to surface conveyors.

The ski season typically begins in mid-November and runs through late-April.

On-Mountain Guest Services

There are six food service outlets on the mountain providing a full range of service levels. Ski school and retail services are available at numerous locations across the resort. Beaver Creek provides skier services at the Beaver Creek Village, Bachelor Gulch Village, Arrowhead Village and Beaver Creek Landing. On-mountain services are provided at Spruce Saddle, Red Tail Camp, Allie's Cabin, Beano's Cabin, Zach's Cabin, Mamie's Mountain Grill, and Arrowhead Mountain Club.

On sunny days Beaver Creek has an on-mountain seating (indoor and outdoor) capacity for 8,835 guests while on an adverse weather day the capacity drops to 6,107 (indoor only). Given the Manage-To number of 13,000 guests, there is inadequate on-mountain seating on busy days to meet the demand—even when the weather is fair and outdoor decks can be utilized. Restaurants in the base area villages (operated by other entities) currently offset the deficit of on-mountain seating. On busy days when the on-mountain restaurants are full, guests may ski down into one of the villages for lunch. Although the village restaurants offset the current on-mountain deficit, having guests descend the mountain for food service is not ideal.

Red Tail Camp and Upper Mountain Utilities

Red Tail Camp is an essential upper mountain component of Beaver Creek's guest services. It provides guest services for skiers and riders using the Grouse Mountain, Birds of Prey, and Larkspur Express Lifts. The restaurant is located more than 30 vertical feet above the Larkspur Express run-out making it difficult to access for skiers and riders egressing from Larkspur Bowl.

It is also the hub of guest services at the finish area of the *Birds of Prey* racecourse. As identified in Beaver Creek's 2010 MDP, Red Tail Camp has a total seating capacity of 475 seats (269 indoor and 206 outdoor), which is undersized for the use it receives on a typical weekend day. This deficiency in seating capacity is especially evident during World Cup Alpine events.

An existing water tank located at Spruce Saddle services Beano's Cabin and Red Tail Camp. While this tank provides sufficient supply and domestic water pressure, additional water, and improvements to the distribution system, are needed for fire suppression. Finally, the current sewer line from Red Tail Camp

runs downhill to where the line joins with the Eagle River Water and Sanitation District line at the bottom of the *Dally* trail is at or near capacity.

Alpine Ski Racing

Alpine ski racing is a unique and important component of Beaver Creek, and is something that sets it apart from other ski areas in the United States. That being said, a core objective of Beaver Creek's 2010 MDP is to "update mountain facilities and infrastructure related to ski racing to continue to provide world class venues for Alpine events."¹⁹

Beaver Creek is home to the *Birds of Prey* racecourse, on which it hosts men's World Cup Downhill, Super G and Giant Slalom events. As the only current venue in the United States for men's World Cup races, *Birds of Prey* has become one of the favorite (and the first) stops on the men's World Cup ski circuit.

Constructed for the 1999 World Alpine Ski Championships, Beaver Creek's *Birds of Prey* racecourse is recognized as one of the premier race courses in the world. Designed by Olympic Downhill gold medalist Bernhard Russi of Switzerland, *Birds of Prey* racecourse starts west of the top of the Cinch chairlift, descending 2,590 vertical feet to Red Tail Camp on *Zoom Room* and *Golden Eagle*. Due to existing grades and surface conditions along the racecourse, substantial depths of machine produced snow are required in some areas to prepare it for the annual World Cup races.

The *Birds of Prey* men's World Cup event typically occurs over a three-day period in early December. Over 20,000 spectators, 300 media members, and 300 volunteers travel to Beaver Creek from all over the world to take part in the event.²⁰ Because the event occurs in early December, much of the mountain is not yet open. It is estimated that approximately 80 percent of the people at the resort are there specifically to attend the event. The remaining 20 percent are presumably skiing and not attending the *Birds of Prey* World Cup event, depending on snow conditions across the mountain.²¹ Many of the volunteers that are needed to host the World Cup event travel from around the country and the world, assisting with this event and also volunteering during the Olympic Games and at other World Cup venues.

¹⁹ Ibid. p. 7

²⁰ For clarity, one spectator is one individual attending one day of the event. Therefore, one individual could be counted multiple times in the total number of event spectators, should they attend multiple days.

²¹ Historically, Alpine racing events in the United States have been rare, and aside from the Lake Placid, Squaw Valley, and, more recently, the Salt Lake City Olympics, there are few events to use as direct comparisons. Therefore, the most logical events to use for estimating attendance at the 2015 World Alpine Ski Championships are the annual World Cup Alpine races that Beaver Creek hosts and the 1999 World Alpine Ski Championships hosted by Vail/Beaver Creek. The 80/20 ratio of destination-to-day visitor is based on information furnished by Vail Resorts.

To accommodate racecourse preparations on *Zoom Room* and *Golden Eagle* (e.g., snowmaking, grooming and safety fencing) the *Birds of Prey* racecourse is closed to guests prior to, during, and immediately following the events. However, the racecourse preparation (i.e., snowmaking and grooming) allows *Zoom Room* and *Golden Eagle* (Advanced Intermediate and Expert trails, respectively) to open to the public earlier than they would were it not for the World Cup event.

Beaver Creek does not have women's Downhill or Giant Slalom racecourses and the *Birds of Prey* racecourse does not meet the FIS technical requirements to host women's events. The absence of a women's race venue currently precludes Beaver Creek from hosting some international Alpine events (including the 2015 World Alpine Ski Championships).

Temporary bleacher seating is erected at Red Tail Finish Stadium for World Cup Alpine events, and the current finish area can comfortably accommodate approximately 4,000 spectators. While the current race finish area at Red Tail Camp meets the needs of the annual World Cup event, it is too small to accommodate the facilities required by the FIS for larger Alpine racing events.

A race building and commentator booths are permanently located at the finish line. A TV/Media compound is located on the northern portion of Red Tail Camp that is used for events coverage. Temporary infrastructure is brought in for specific race events, including bleacher seating, video screens and additional tents for guest services. It is noteworthy that the annual World Cup events occur early in the season (early December) when much of Beaver Creek's terrain is not yet open. Therefore, snowmaking and grooming in preparation for the annual *Birds of Prey* World Cup event benefits the public by opening expert terrain immediately following event.

Race Event Spectating

Spectator parking is available in the complimentary parking lots and along Highway 6 at the base of Beaver Creek Resort. Regularly scheduled free shuttles bring spectators to the Covered Bridge stop where special race shuttles take them to the Red Tail Finish Stadium. Race event shuttles run every five to ten minutes throughout the day. From the shuttle drop location, there is a steep five- to ten-minute hike up the *Dally* road to the Red Tail Finish Stadium.

In addition to riding shuttle buses to the event, spectators can ski to the finish area by following *Redtail* from the top of Centennial Lift (#6), to above where the *Birds of Prey* racecourse crosses *Redtail*. From there, they follow the utility corridor to *Dally* and the north end of the Red Tail Finish Stadium where they can consult maps and signage for seating areas.

Along the *Birds of Prey* racecourse, advanced skiers have one option for a clear view of racers for a relatively long period (roughly 25 to 30 seconds). They can descend *Goshawk* or *Peregrine* and then follow the short, steep *Goshawk* connector trail that provides access to the Pump House on *Golden Eagle*. From that point, spectators have a clear view of racers as they descend the roughly 2,600-vertical foot

course, which typically takes between 1:40 and 1:55 to complete (depending on conditions). This is not ideal, as spectators are required to navigate a steep pitch and hike out after the events have concluded. Furthermore, because of the early season nature of this event, low snow can complicate egress.

Due to the nature of Alpine ski racing, the *Birds of Prey* racecourse follows expert trails, thereby limiting areas from which intermediate- and beginner-level skiers can view it. While intermediates can descend *Redtail* and view the lower portion of the racecourse, beginner skiers can only view the racecourse from the Red Tail Finish Stadium.

Summer Recreation

During the summer, Beaver Creek operates the Centennial Express from the Village to Spruce Saddle. Spruce Saddle has become a starting point for mountain bikers and hikers, in addition to being a popular location for both wedding and group events.

The Beaver Creek Activities Center offers guided hikes and other activities. For those who wish to hike on their own, trails throughout Beaver Creek's private and public lands are identified on summer trail maps. Beaver Creek's 37.6-mile summer trail network stretches from Spruce Saddle to the base of Arrowhead. The summer trail network includes a combination of hiking, biking, equestrian, and multiple use trails.

A separate entity operates under an outfitter and guide permit from the WRNF for horseback tours. With the exception of dinner rides to Beano's Cabin and day rides to Beaver Lake, the equestrian trails all leave the SUP area to the east.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

Resort Capacity

Beaver Creek's CCC (15,320) would remain unchanged as a result of Alternative 1. Beaver Creek and the Forest Service would continue to utilize the Manage-To process to manage for health, safety and welfare considerations, and a high quality skier experience.

Lift and Terrain Network

No changes to Beaver Creek's lift and terrain network would occur under Alternative 1.

On-Mountain Guest Services and Upper Mountain Utilities

Under Alternative 1, no changes or modifications would occur to Beaver Creek's on-mountain guest service facilities. In particular, and as identified in Beaver Creek's 2010 MDP, Red Tail Camp would remain undersized for the use it experiences on a typical weekend day. This deficiency would continue to

be noticeably pronounced by guests during the annual World Cup Alpine events. For guests descending Larspur Bowl, Red Tail Camp would be difficult to access.

Existing deficiencies in water supply/pressure for fire suppression and sewage line capacity at the upper mountain would not be addressed in this alternative.

Alpine Ski Racing

For the foreseeable future, Beaver Creek will continue to host the only men's World Cup Alpine event in the United States; however, Alternative 1 would not address Beaver Creek's existing lack of a racecourse that meets FIS requirements for hosting women's Downhill or Giant Slalom events. Therefore, it would not be possible for Beaver Creek to host the 2015 World Alpine Ski Championships under Alternative 1.

The existing *Birds of Prey* men's racecourse (which accommodates Downhill, Super G and Giant Slalom events) would remain unchanged. Therefore, identified technical issues along the racecourse would persist, requiring substantial depths of machine produced snow to be made and representing a challenge for Beaver Creek to bring the racecourse to FIS specifications each year because of the inefficient use of snowmaking.

On-mountain spectator access to the *Birds of Prey* racecourse would continue to be provided by the connector trail that provides access to the Pump House on *Golden Eagle*.

The existing TV/Media compound located on the northern portion of Red Tail Camp would not be expanded, but would continue to meet the existing need. A temporary structure would continue to be assembled at the top of the Birds of Prey Express for World Cup events under the No Action Alternative.

Summer Recreation

Summer recreation would be unaffected under Alternative 1.

Alternative 2 – Proposed Action

Resort Capacity

None of the projects included in Alternative 2 would affect the capacity of Beaver Creek's lift or trail network. Therefore, Beaver Creek's CCC (15,320) would remain unchanged as a result of the projects contained in Alternative 2. Beaver Creek and the Forest Service would continue to utilize the Manage-To process to manage for health, safety and welfare considerations, and a high quality skier experience.

Lift and Terrain Network

No changes to Beaver Creek's lift network would occur under Alternative 2. Proposed changes to the terrain network are specifically related to Alpine ski racing, i.e., to provide specific trail additions and connectors that would facilitate linking existing trails together for the creation of men's and women's

racecourses. It is not anticipated that the general public would recognize any additional terrain in a way that effects (either beneficial or detrimental) the recreational experience throughout the ski season.

On-Mountain Guest Services and Upper Mountain Utilities

Under Alternative 2, Red Tail Camp would be relocated and replaced with a new building, accommodating approximately 600 indoor seats (500 indoor cafeteria seats and 100 indoor table service seats), and roughly 160 outdoor seats. Because Red Tail Camp is a critical component of the annual World Cup Alpine races, replacing this facility would benefit this annual event, as well as benefit the 2015 World Alpine Ski Championships. Replacing this facility would better accommodate the existing demand during typical weekend and/or adverse weather days. Finally, because the existing restaurant is located more than 30 vertical feet higher than the Larkspur Express run-out, the relocated facility would make it easier for guests egressing from Larkspur Bowl as it would be at or near the elevation at the bottom of the bowl, eliminating the need to go uphill.

Alpine Ski Racing

Alternative 2 responds to a key goal and objective of the 2010 MDP which is to: “update mountain facilities and infrastructure related to ski racing and continue to provide world class venues for Alpine events.” Likewise, improving Beaver Creek as a venue for international Alpine ski racing is consistent with the resort’s culture and its market. Under Alternative 2, a few key terrain improvements/additions (e.g., grading, widening, new trail segments, and snowmaking) would enable Beaver Creek to meet FIS requirements for both men’s and women’s Alpine race events. The proposed projects would not only enable Beaver Creek to improve the men’s *Birds of Prey* racecourse, but it would be able to host women’s Downhill and Giant Slalom events, thus enabling it to host the 2015 World Alpine Ski Championships.²²

Under Alternative 2, the addition of the women’s Downhill racecourse safety nets would preclude use of the existing spectator access route that accommodates viewing the men’s *Birds of Prey* racecourse. Therefore, that access route would be abandoned and a new one is proposed to be constructed between *Goshawk* and *Peregrine* that would enable event spectators to reach the middle portion of both the men’s and women’s Downhill racecourses.²³ Furthermore, by widening an existing utility corridor (and adding snowmaking) between Red Tail and the *Dally* catwalk, circulation would be improved for skiers/riders descending from the top of the Centennial Express to the finish area at Red Tail Camp. The addition of both men’s and women’s racecourses within the Birds of Prey pod and on Grouse Mountain would increase options for spectators to view events on-course rather than being limited to existing mid-course

²² Note: for safety and operational reasons, it would not be possible to have separate races run concurrently (i.e., only one racecourse could be in operation at a time).

²³ Because the men’s and women’s Downhill racecourses would be parallel to each other, Beaver Creek would accommodate guests crossing over the women’s Downhill racecourse to reach the spectating area for the men’s racecourse.

locations or the finish area (i.e., they could follow the Birds of Prey Express corridor or descend Goshawk and Peregrine). Specific viewing areas have not been established at this time.

For safety and security reasons, the men's and women's racecourses themselves would be closed to the public prior to, during, and immediately following the 2015 World Alpine Ski Championships. It is anticipated that the individual trails that make up the separate racecourses would be closed for approximately one month prior to the event and two weeks after the event for snow surface preparation, safety fencing, and television broadcast set up and tear down. During this time, access to ski terrain by resort guests in the project area would be restricted.

The 2015 World Alpine Ski Championships are scheduled to occur during a time of the year (February) when snow levels are typically sufficient for 100 percent of the skiable terrain at Beaver Creek to be open. Therefore, skiers and riders would have access to ample terrain across the ski area, which would offset the recreational impacts of trail closures on Grouse Mountain and within the Birds of Prey pod related to the World Alpine Ski Championships. For comparison, the annual World Cup event affects a greater proportion of the terrain at Beaver Creek because of the early season nature of this event (i.e., less of the mountain is actually open for skiing, so closing off trails within the Birds of Prey pod has a proportionally greater effect).

Skier access to the finish area during the 2015 World Alpine Ski Championships would be via two mechanisms:

1. *Red Tail* (accessed from the Centennial Express) would be open to the public to the utility corridor allowing spectators to ski to the finish area, access Chairs 9, 10 and 11, or return to Beaver Creek Village via *Dally*.
2. Larkspur Bowl, which can be accessed from the top of the Strawberry Park Express, out of Beaver Creek Village and the Upper Beaver Creek Mountain Express, out of Bachelor Gulch.

Because the Birds of Prey Express crosses over the proposed women's Downhill racecourse, it would be closed to the public during the women's Downhill events to minimize the potential for objects to fall onto the racecourse.²⁴ All other chairlifts and terrain would be open to the public as usual at this time of year.

Summer Recreation

Under Alternative 2 the majority of Beaver Creek's summer recreation programs would be unaffected. Implementation of Alternative 2 would result in the temporary closure of the Royal Elk Trail, a summer hiking trail, during construction activities. The Royal Elk Trail extends from Spruce Saddle to Beaver Lake and crosses under both the Birds of Prey Express and Grouse Mountain Express chairlifts at

²⁴ Course workers, coaches, and athletes would be the exception.

approximately their midpoint. Royal Elk receives relatively small amounts of public use during the summer season.

During construction activities in the Red Tail Camp area, Dally Road (a multiple use trail)—which extends from Beaver Creek Village to Red Tail Camp—would be intermittently closed to avoid conflicts between recreational users and construction equipment. Traffic control would ensure that public safety is not compromised. To minimize disruption to recreational users, notices would be placed at trailheads and Beaver Creek Village informing users of construction activities and trail closures (refer to Recreation PDF– Table 2-1).

Beaver Creek operates approximately 37.6 miles of summer recreation trails. Although Alternative 2 would require the temporary closure or reroute of two summer trails, it is anticipated that recreational users would utilize other trails offered at Beaver Creek and would otherwise be unaffected.

CUMULATIVE EFFECTS

Appendix A includes a list of past, present, and reasonably foreseeable future projects have been identified by the Forest Service as relevant from a cumulative effects context.

Temporal and Spatial Extent of Analysis

The spatial extent of the cumulative effects analysis is the Beaver Creek SUP area. The temporal bounds for this cumulative effects analysis extends from 1988, when Beaver Creek first held the World Alpine Skiing Championships, into the foreseeable future in which Beaver Creek is expected to continue to host annual World Cup events.

Alpine Ski Racing at Beaver Creek

As discussed previously, Alpine ski racing is a unique and important component of Beaver Creek, and is something that sets it apart from other ski areas in the United States. A core objective of Beaver Creek’s 2010 MDP is to “update mountain facilities and infrastructure related to ski racing to continue to provide world class venues for Alpine events.”

The only past, present and reasonably foreseeable future recreational activity that has affected, or will be affected by, Alternative 2 is the annual World Cup event at Beaver Creek, which will presumably be held at Beaver Creek into the long-term future. Since 1999 the *Birds of Prey* men’s racecourse has defined Beaver Creek on the international Alpine race scene, and will continue to do so regardless of which alternative is selected.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

No irreversible and/or irretrievable commitment of the recreation resource has been identified in association with the Proposed Action.

B. TRAFFIC, PARKING, AND SKI AREA ACCESS

SCOPE OF THE ANALYSIS

The traffic analysis assesses environmental baseline traffic and projected traffic effects from the Proposed Action. The proposed projects are not designed to, nor are they expected to, affect annual visitation at Beaver Creek. Therefore, they are not anticipated to affect traffic throughout the ski season. However, the 2015 World Alpine Ski Championships are anticipated to generate a short-term spike in traffic for a 13-day period in February.

Historically, Alpine racing events in the United States have been rare, and aside from the Lake Placid, Squaw Valley, and, more recently, the Salt Lake City Olympics, there are few events to use as direct comparisons. Therefore, because of the similarity between the annual *Birds of Prey* World Cup races and the 2015 World Alpine Ski Championships, this analysis uses the annual *Birds of Prey* World Cup races as the baseline for which to estimate the impacts to traffic, parking and ski area access related to the Proposed Action.²⁵ Therefore, the scope of this traffic, parking, and ski area access analysis is limited to the annual *Birds of Prey* World Cup races typically held over a period of three days in the early season (typically in early December) and the 2015 World Alpine Ski Championships, which would be hosted at Beaver Creek if the Proposed Action is approved.

AFFECTED ENVIRONMENT

Ski Area Access

Beaver Creek can be accessed by flying into Eagle County Airport or Denver International Airport, or by vehicle along I-70. I-70 is Colorado's major east-west travel corridor that provides access to Beaver Creek from the Denver metropolitan area (approximately 120 miles or approximately 2 to 2½ hours driving time, depending on weather and traffic volumes), through the Eisenhower-Johnson Memorial Tunnel (Eisenhower Tunnel). Eastbound access from Grand Junction and Glenwood Springs to the ski area also occurs primarily via I-70.

Drivers access Beaver Creek by exiting I-70 at exit 167 in Avon and taking Avon Road, to the Village Road for access to Beaver Creek Village. Highway 6 parallels the south side of I-70 and provides access to lodging, retail, and services throughout the western side of Vail Valley. It is also possible for drivers to access Beaver Creek by exiting I-70 at exit 169 in Eagle-Vail and following the Post Road to Highway 6.

²⁵ It is important to note that Vail/Beaver Creek has previously hosted the 1989 and 1999 World Alpine Ski Championships.

Access for Alpine Racing Events

For race spectators who do not ski, shuttle buses run every five minutes during the annual *Birds of Prey* World Cup event throughout the day. The buses run from the west and east parking areas located along Highway 6 (discussed below under “Skier Parking”), dropping spectators off at the Covered Bridge stop on Village Road at the base of the ski area. From the Covered Bridge stop, another shuttle travels to the Red Tail Finish Stadium at Red Tail Camp. Transportation is also available on training days, running uninterrupted to and from the Red Tail Finish Stadium and the Covered Bridge stop. Further volunteer and spectator transportation is provided by the Avon and Eagle County bus systems (ECO Transit) operating a daily bus service between Vail, Beaver Creek, Avon, and Edwards with pick-up in Beaver Creek Village.

Traffic

Existing traffic congestion along I-70, particularly from Glenwood Springs to Denver through the Eisenhower Tunnel, is degrading the accessibility of mountain travel on weekends throughout the summer and winter.²⁶ This congestion is particularly apparent during peak weekends throughout the winter and summer, when the greatest number of people are traveling from the Front Range to the mountains along I-70. Traffic congestion is compounded during these times since the Interstate also provides access for freight, local residents, and interstate commerce.²⁷

On winter weekends, congestion typically occurs between Silverthorne (milepost 205) and C-470 (milepost 260). Specifically, this congestion occurs during the morning (westbound, to the resorts) and afternoon/evening (eastbound, returning to the Front Range) on both Saturdays and Sundays. The evening peak eastbound is most severe on Sundays, as people who stayed in the mountains all weekend return to the Denver area along with day skiers.²⁸

CDOT records traffic volumes on state highways and Colorado interstate highway systems. Average Daily Traffic (ADT) is the number of vehicles passing a count location in both directions in a 24-hour period. Raw ADT data is processed and converted to Average Annual Daily Traffic (AADT) volumes, defined as the total volume of traffic on a road segment for one year, divided by 365 days. Both directions of traffic volumes are reported. AADT can be adjusted to compensate for monthly and daily fluctuations in traffic; the basic intent being to provide traffic volumes which best approximate the use of a given highway section for a typical day of the year.

Table 3B-1 shows baseline (Year 2010) AADT volumes at key points along I-70.

²⁶ I-70 Coalition, 2008

²⁷ CDOT, 2011

²⁸ Ibid.

Table 3B-1:
AADT (Year 2010) Along I-70

I-70 Monitoring Point	CDOT Ref. Pt.	AADT
Officer's Gulch (between Copper Mountain and Frisco)	195.258	22,000
Vail Pass	179.866	19,000
Dowds Junction (Minturn)	171.105	32,000
Edwards Interchange	166.635	27,000
Castle Peak (Wolcott)	156.547	22,000

Source: CDOT 2010

The I-70 Mountain Corridor Programmatic EIS analyzed the Level of Service (LOS) along I-70 from mile marker 163 (Edwards) to the East Vail exit (mile marker 180) in 2000.²⁹ The Highway Capacity Manual and American Association of State Highway and Transportation Officials (AASHTO) Geometric Design of Highways and Streets ("Green Book") list the following levels of service:

A= Free flow

B=Reasonably free flow

C=Stable flow

D=Approaching unstable flow

E=Unstable flow

F=Forced or breakdown flow

As noted above, a LOS A rating represents ideal conditions where traffic is free flowing, where a LOS F rating describes a breakdown in vehicular flow. For clarity, roads and highways operating at a LOS of E or F are at capacity. Traffic volumes greater than this value should be expected to be unstable and stop-and-go conditions could occur at any time.

Table 3B-2 illustrates that I-70 between Dowds Canyon (Minturn) and the West Vail exit functions at LOS D eastbound on Fridays and summer weekends. I-70 functions at LOS C westbound for all other analysis days.

²⁹ Ibid.

Table 3B-2:
LOS Between Mile Marker 163 and 180

Direction and Time		ADT	Peak-Hour Volume	LOS
Eastbound	Weekday	21,700	1,680	C
	Friday	23,800	1,860	D
	Winter Weekend	13,900	1,070	B
	Summer Weekend	31,100	1,720	D
Westbound	Weekday	20,000	1,900	C
	Friday	24,600	2,080	C
	Winter Weekend	16,300	1,690	C
	Summer Weekend	21,500	1,660	C

Source: CDOT, 2011

Over the past 10 years Beaver Creek's annual visitation has averaged approximately 840,000 guests. This includes both destination and daily guests (destination guests represent 80 percent of Beaver Creek's visitation). Assuming a roughly 150-day operating season between November and April of each year, this equates to an average daily visitation of roughly 5,600 people. Based on Beaver Creek's 10-year average daily visitation, Table 3B-3 provides average daily traffic associated with Beaver Creek's winter daily and destination guests.

Table 3B-3:
Average Daily Traffic Contributions to I-70 Associated with Beaver Creek's Winter Operations

	Total	Destination Skiers (80% of total)	Day Skiers (20% of total)
Annual Average Visitation	840,000 skiers	672,000 skiers	168,000 skiers
Daily Visitation ^a	5,600 skiers/day	4,480 skiers/day	1,120 skiers/day
Average Daily Round Trips	704 round trips	256 round trips ^b	448 round trips ^c

^a Based in an average 150-day operating season

^b Based on an average vehicle occupancy rate of 2.5 people. Destination guests at Beaver Creek stay, on average, for seven days and therefore contribute one round trip on I-70 over the course of their stay. (Note: Beaver Creek's 2010 MDP uses 2.8 people/vehicle for an average vehicle occupancy rate; however, 2.5 leads to a more conservative estimate.)

^c Based on an average vehicle occupancy rate of 2.5 people

As displayed in Table 3B-3, Beaver Creek's operations between November and April of each year have been calculated to contribute, on average, approximately 704 round trips per day on I-70. This represents approximately 4.4 percent of AADT for I-70 at Dowds Junction (which CDOT has calculated at 32,000; refer to Table 3B-1). Most, but not all, of Beaver Creek's guests would presumably be driving past Dowds Junction; the majority of destination guests fly into and out of DIA, and the majority of day skiers come from the eastern side of the state. Obviously, this is higher on busy weekends and throughout holiday periods. Note that the daily trips associated with Beaver Creek's destination guests reflects that these guests stay at the resort for, on average, seven nights, and therefore only contribute to traffic on I-70 on the arrival and departure of their stay.

Traffic During the Annual Birds of Prey World Cup Event

The annual *Birds of Prey* World Cup event draws a total of approximately 20,000 spectators, 300 media members and 300 volunteers for three days of Alpine ski racing. Note that a single person attending all three days of racing counts as three “spectators” over the course of the event. The majority of people stay for more than one day of racing.

The event occurs during Beaver Creek’s early season and is not a peak visitation time. In fact, much of the terrain on the mountain is not typically open during early December. However, the *Birds of Prey* World Cup event tends to draw additional guests to Beaver Creek during this weekend, increasing traffic volumes between the Avon exit on I-70 and through town to higher than what is typical for the early season.³⁰ Elevated traffic volumes related to the *Birds of Prey* World Cup event are temporary in nature, and represent an insignificant contribution to congestion on I-70 during the three days of racing.

Table 3B-4 provides average daily traffic associated with Beaver Creek’s annual World Cup event, in which 20,000 spectators typically participate across three days of Alpine racing. As with Beaver Creek’s annual visitation, 80 percent of the *Birds of Prey* World Cup spectators are presumed to be destination guests, and stay for seven nights, encompassing the event.

Table 3B-4:
Average Daily Traffic Contributions to I-70 Associated with
Beaver Creek’s *Birds of Prey* World Cup Event

	Total	Destination Spectators (80% of total)	Day Spectators (20% of total)
Total World Cup Spectators	20,000 spectators	16,000 spectators	4,000 spectators
Daily World Cup Spectators ^a	6,666 spectators/day	5,333 spectators/day	1,333 spectators/day
Average Daily Round Trips ^a	838 round trips/day	305 round trips/day ^b	533 round trips/day ^c

^a Based on three days of Alpine racing event

^b Based on an average vehicle occupancy rate of 2.5 people. Beaver Creek’s average 7-day duration for destination guests applies to the annual World Cup event, as well

^c Based on an average vehicle occupancy rate of 2.5 people

As displayed in Table 3B-4, Beaver Creek’s annual *Birds of Prey* World Cup event has been calculated to contribute, on average, approximately 838 round trips per day on I-70. As with the daily vehicular traffic estimations presented in Table 3B-3, daily trips associated with destination guests reflects that these guests stay at the resort for, on average, seven nights, and therefore only contribute to traffic on I-70 on the frontend and backend of their stay.

³⁰ It is estimated that approximately 80 percent of the people at the resort during the *Birds of Prey* World Cup are there specifically to attend the three day event. The remaining 20 percent are presumably skiing and not attending the event, depending on snow conditions across the mountain.

Of the 80 percent that attend the *Birds of Prey* World Cup event, 20 percent are assumed to attend the event as day visitors originating their trip approximately 2-3 hours driving distance from the resort, the majority of which come from the Colorado Front Range (e.g., Denver, Boulder, Fort Collins).

Skier Parking

Public parking at Beaver Creek is accommodated in 13 lots located throughout Avon and at Beaver Creek Village, accommodating approximately 7,900 guests/employees. Parking is available at the free lots in Avon throughout the winter season. A daily fee is charged for parking in garages at Beaver Creek Village.

On busy days, parking demand at Beaver Creek is driven by skiers arriving in their personal vehicles, and is exacerbated by the mountain's employees, the village's non-mountain employees, village shoppers and construction workers. On most days, the existing parking lots are adequate and supply meets demand. On up to 15 days per season, all parking areas are completely full and overflow parking occurs on Highway 6 and on the Avon Rodeo grounds (discussed below).

The existing public and employee parking lots and their vehicles capacities are shown in Table 3B-5.

**Table 3B-5:
Parking Lots and Capacities – Existing Conditions**

Parking Supply	Public Vehicles	Employee Vehicles	TOTAL Vehicles
Elk Lot	300	300	600
Bear Lot	600	100	700
Prater Road	100	0	100
Wolf Lot	280	150	430
Tarnes	0	70	70
Municipal Services	0	41	41
Arrowhead	240	10	250
Village Hall	141	50	191
Elk Horn	70	0	70
Villa Montane	160	0	160
St James Place	174	0	174
Service Center	0	50	50
TOTAL	2,065	771	2,836

Source: SE Group

On anticipated peak days throughout the season, including during the annual *Birds of Prey* World Cup event, the parking supply/demand imbalance is offset through the use of CDOT permits to park up to 150 cars on Highway 6. In addition, Beaver Creek has historically leased the Avon Rodeo Grounds (the "Rodeo Lot" with a capacity for approximately 800 vehicles) on peak days. Due to its remote location and need for additional busses, using the Rodeo Lots for parking tends to complicate the transportation system, but is nonetheless utilized when necessary.

Beaver Creek coordinates with the Town of Avon and uses electronic signs to direct arriving vehicles to available parking lots, Highway 6, or to the Rodeo Lot (when it is utilized). Parking attendants are also

stationed at each lot as it fills to direct guest to available parking facilities. State Patrol is contacted at the beginning of the ski season with dates that vehicles will be parked on Highway 6.

Locals who do not drive (or use mass transportation), and destination skiers who stay for multiple days do not contribute to parking needs/constraints. Furthermore, the bed base at Beaver Creek, Bachelor Gulch, Arrowhead and Avon offsets parking demands because guests staying in local accommodations do not utilize day skier parking. Finally, the River Front Gondola that connects Avon to the Beaver Creek Express lift at the Beaver Creek Landing serves the existing bed base in the center of Avon, thereby decreasing parking demand generated in Avon.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

Ski Area Access

Access to Beaver Creek under Alternative 1 would be as described in the Affected Environment.

Access for Alpine Racing Events

Under the No Action Alternative, spectator access to annual *Birds of Prey* World Cup Alpine racing events would continue to be as described in the Affected Environment.

Traffic

Beaver Creek's seasonal (winter) contribution to AADT on I-70—calculated at roughly 2.2 percent for the Dowds Junction monitoring point—is not anticipated to change significantly given anticipated increases in traffic volumes for the I-70 corridor.

Under Alternative 1, traffic on I-70 is anticipated to worsen commensurate with population increases throughout the Front Range and mountain communities. With the exception of the Dowd Canyon exit on I-70, which is anticipated to achieve a LOS of E (eastbound and westbound) by 2015, CDOT anticipates that all other portions of I-70 between mileposts 163 and 180 will continue to operate at LOS D or better.³¹

Because there would be no new projects approved under Alternative 1, Beaver Creek would not be able to host the 2015 World Alpine Ski Championships. However, the annual *Birds of Prey* men's World Cup event will continue to be held over a 3-day period, typically in early December.

Similar to the Existing Condition, short-term spikes in traffic would be anticipated immediately before and after the *Birds of Prey* World Cup event as visitors/spectators access the venue to attend the event. These traffic effects are expected to be temporary in nature, related to the 3-day event, and return to pre-

³¹ CDOT, 2011

event conditions shortly after completion of the races (identical to the Existing Condition). Therefore, as is currently the case, World Cup attendees would continue to incrementally, but insignificantly, contribute to traffic on I-70 over the three days of racing—typically in early December.

Parking

Demand for, and supply of, resort parking throughout the year (including the *Birds of Prey* World Cup events) would not change under the No Action Alternative. On most days, the existing parking lots are adequate, with supply meeting demand. As with the existing conditions, on up to 15 days per season, all parking areas can be expected to be completely full and overflow parking would likely continue to occur on Highway 6 and on other offsite parking areas.

Alternative 2 – Proposed Action

Ski Area Access

Ski area access would not change under, nor would it be affected by, Alternative 2.

Access for Alpine Racing Events

Under Alternative 2, access for future racing events—including the annual *Birds of Prey* World Cup and the 2015 World Alpine Ski Championships—would be as described in the Affected Environment under “Access for Alpine Racing Events.” Beaver Creek has been hosting Alpine ski racing events on an annual basis dating back to 1999, and is well equipped to host larger events.

Traffic

As with Alternative 1, Beaver Creek’s contribution to AADT on I-70—calculated at roughly 2.2 percent for the Dowds Junction monitoring point—is not anticipated to change significantly given anticipated increases in traffic volumes for the I-70 corridor. Due to the nature of the projects included in the Proposed Action, which are focused on hosting larger, international Alpine skiing events (including, but not limited to the 2015 World Alpine Ski Championships), annual visitation at Beaver Creek is not anticipated to increase as a result of Alternative 2.

Traffic Contributions from 2015 World Alpine Ski Championships Attendees

Visitation and traffic associated with the 2015 World Alpine Championships would be expected to increase immediately preceding, following, and to a lesser extent, during the 13-day event, but otherwise, traffic volumes on regional highways serving Beaver Creek would be expected to resemble those currently observed in the Affected Environment (i.e., during the *Birds of Prey* World Cup). The 2015 World Alpine Ski Championships are anticipated to generate up to a total 39,100 attendees (or 120,000 visits by attendees across 13 days of racing), including pre- and post-race periods. It is important to note that the 120,000 visits anticipated during the duration of the event does not equate to 120,000 individuals, as people can be expected to attend multiple day's worth of events. For the purposes of this analysis,

“attendees” (which include all individuals who are in attendance across multiple days of the event, totaling 39,100) are defined as:

- 550 athletes
- 550 team supporters
- 1,800 members of the media
- 1,200 sponsors
- 5,000 supporters (industry and team members who travel to major events in support of their Federation and sport)
- 30,000 spectators

It is assumed that spectators would be composed of 80 percent destination visitors (i.e., they would drive to Beaver Creek, stay for multiple days, and then drive back home or to DIA or Eagle County Airport, accounting for one round-trip on I-70). The remaining 20 percent of spectators would presumably be day skiers who drive to and from Beaver Creek in a single day to view specific events, primarily from points along the Front Range (i.e., within a 2 to 3 hour driving distance of Beaver Creek). Ninety-five percent (or higher) of all other attendees would be assumed to be staying at Beaver Creek, Avon or Vail for all, or most of, the 2015 World Alpine Ski Championships (again accounting for one round-trip on I-70).

The majority of volunteers for the 2015 World Alpine Ski Championships are expected to originate from within the Vail Valley and carpool or use mass transportation. Additionally, media members are expected to arrive earlier than spectators, be lodged locally, and stay for the length of the event. Therefore, media and volunteer contributions to regional traffic are expected to be minimal and discountable.

While it is not possible to predict attendance or related traffic for the 2015 World Alpine Ski Championships with precision, average daily traffic related specifically to the 13-day event is estimated at between 800 and 900 vehicle roundtrips. This is based on Beaver Creek’s history with hosting the World Alpine Ski Championships—in both 1989 and 1999—as well as the annual *Birds of Prey* World Cup event. Peak daily traffic contributions (on weekends and in conjunction with more popular racing events) can be assumed to be substantially higher—perhaps 200 to 300 percent higher.

For comparison purposes, average daily visitation at Beaver Creek during the month of February is roughly 6,000 skiers. Accounting for Beaver Creek’s existing market, which is comprised of 80 percent destination /20 percent day skiers, this equates to approximately 4,800 destination skiers who stay at Beaver Creek for multiple days, and 1,200 skiers who drive to and from the resort in a single day. At 2.5 skiers-per-vehicle, Beaver Creek’s day skiers currently contribute roughly 480 daily roundtrips on I-70. Therefore, the average 800 to 900 daily roundtrips estimated to be generated across the 13-day 2015 World Alpine Ski Championships would represent an incremental and short-term impact to traffic during

the first half of the month of February as vehicles exit I-70 at Avon and navigate their way to spectator parking. However, traffic associated with more popular days of racing (and on weekends) can be expected to be substantially higher and could significantly impact traffic flows.

As was previously stated, Beaver Creek has been hosting Alpine ski racing events on an annual basis dating back to 1999, and is well equipped/prepared to host larger events. Similar to what it has done for previous Alpine racing events, Beaver Creek would continue to coordinate with the Town of Avon and State police in regards to anticipated high attendance days. Furthermore, electronic signs would be used to direct arriving vehicles to available parking lots, Highway 6, or to the Rodeo Lot (when it is utilized). Parking attendants would be used to direct arriving vehicles to available parking facilities. Additionally, measures will be developed in coordination with Beaver Creek to promote strategies to reduce vehicle use. This may include the availability of additional vans or buses owned and operated by Vail Resorts, Inc. By utilizing available resources to promote the use of regional transportation for employees, volunteers, and guests, a tangible reduction in the number of daily vehicle trips and an increase in the average vehicle occupancy (AVO) rate can be achieved.

To minimize traffic contributions directly related to the 2015 World Alpine Skiing Championships, and reduce vehicle trips through the lynx linkage areas, additional measures will be developed in coordination with Beaver Creek to promote strategies to reduce vehicle use. This may include the availability of additional vans or buses owned and operated by Vail Resorts, Inc. By utilizing available resources to promote the use of regional transportation for employees, volunteers, and guests, a tangible reduction in the number of daily vehicle trips and an increase in the average vehicle occupancy (AVO) rate can be achieved.

Parking

Demand for, and supply of, resort parking throughout the year would not change under Alternative 2. Under Alternative 2 parking demand during the 2015 World Alpine Championships would be expected to resemble, although perhaps exceed, demand observed during the annual 3-day *Birds of Prey* World Cup events. It is important to note that the 120,000 spectators anticipated to attend the event does not equate to 120,000 individuals. Specifically, this number accounts for 30,000 individuals who are expected to attend multiple days of Alpine racing events over the two-week period.

As with Alternative 1, parking for spectators and volunteers would be provided at the parking lots in Avon. All lots contributing to Beaver Creek's parking capacity, illustrated in Table 3B-3, would be utilized to accommodate race spectators under Alternative 2.

Parking capacity for additional vehicles has historically been accommodated through a combination of Colorado Department of Transportation permits (150 vehicles) and use of the Rodeo lot (800 vehicles) in Avon (as in Alternative 1). During the 2015 World Alpine Ski Championships, Beaver Creek's public safety department, along with parking attendants, would be used to direct and efficiently park spectator's

vehicles as they arrive in Avon. Although demand for parking would be high as the resort would continue to provide day skier parking as well as to accommodate event spectators, this would represent a short-term operational challenge. Existing parking capacity (including CDOT permits to parking on roads and other offsite parking areas), combined with regional bus service and event related shuttles, is expected to meet anticipated demand.

CUMULATIVE EFFECTS

Appendix A includes a list of past, present, and reasonably foreseeable future projects have been identified by the Forest Service as relevant from a cumulative effects context.

Temporal and Spatial Extent of Analysis

The temporal extent of this cumulative effects analysis extends back to 1999, when Beaver Creek constructed the *Birds of Prey* racecourse and began hosting the annual World Cup event, and extends into the foreseeable future in which Beaver Creek is expected to continue to host annual World Cup events. The spatial extent of the cumulative effects analysis is the I-70 corridor in the vicinity of the Avon exit.

Alpine Ski Racing at Beaver Creek

With implementation of projects contained in Alternative 2, Beaver Creek could potentially host more Alpine racing events in the future. When considered with past, present and future Alpine racing events and operations at Beaver Creek, traffic, parking and ski area access would continue to be provided to accommodate needs of the attendees, and traffic impacts on I-70 associated with those events would be short-term and manageable. However, beyond the annual World Cup events and the 2015 World Alpine Ski Championships, future Alpine events being held at Beaver Creek are purely speculative and cannot be accounted for in this analysis.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

No irreversible and/or irretrievable commitments of resources in relation to traffic have been identified in association with any of the alternatives analyzed in this document.

C. SCENERY

SCOPE OF THE ANALYSIS

The project area for this scenery analysis is limited to the Birds of Prey, Grouse Mountain, and Larkspur lift/trail pods and the Red Tail Camp area, all of which are located in a portion of the resort referred to as the “Upper Mountain.” As discussed below, aside from within the ski area, the Beaver Creek SUP area is only visible from limited vantage points along the I-70 corridor in the vicinity of Avon, which is the critical viewpoint used in this analysis.

The aesthetic impacts of the proposed changes within the project area were considered in relation to the overall existing development/recreational theme of the resort. Analysis of the aesthetic environment requires an evaluation of the project area and its ability to absorb the effects of both historic and ongoing human modification. Slope, natural vegetation types and patterns, topography, and viewing distance are important factors in this analysis. The development of skier facilities, infrastructure, and developed trails on NFS and private lands within the ski area has occurred over the past three decades over which time the area has been managed as a winter recreation site. Thus, Beaver Creek has developed into a concentrated four-season resort, and due to its nature as a developed ski area, it is reasonable to assume that the majority of viewers expect it to appear as such.

MANAGEMENT OF THE SCENIC ENVIRONMENT ON NATIONAL FOREST SYSTEM LANDS

The Scenery Management System (SMS) was adopted in 1995 as the primary scenery management direction by the Forest Service. In brief, the SMS is a systematic approach for assessing scenic resources in a project area to help make management decisions on the project.

Scenic Integrity Objectives and Landscape Character

An action can cause changes to scenic resources that can be objectively measured. By assessing the existing scenic character of an area in terms of pattern elements (form, line, color and texture) and pattern character (dominance, scale diversity and continuity), it is possible to identify the extent to which the scenic character would exhibit scenic contrast with the landscape, or its converse—scenery compatibility.

The 2002 Forest Plan establishes acceptable limits of change for Scenic Resources.³² The acceptable limits of change of a particular area (e.g., Management Area, as defined in the 2002 Forest Plan) are the documented Scenic Integrity Objectives (SIO), which serve as management goals for scenic resources. SIOs provide a measure of visible disruption of landscape character, ranging from “*Very High*” to “*Unacceptably Low*.” In order of least-to-most altered, SIOs are:

³² USDA Forest Service, 2002a

- **Very High** (unaltered)
- **High** (appears unaltered)
- **Moderate** (slightly altered)
- **Low** (moderately altered)
- **Very Low** (heavily altered)
- **Unacceptably Low** (extremely altered)

For reference, *Very High* SIOs are typically found in designated wilderness areas and special interest areas. While there is no standard for SIOs in relation to ski area SUP areas on NFS lands, in most cases, they fall somewhere between *Very Low* and *Moderate*. This is in recognition of the developed nature of ski areas, which tend to operate in highly scenic environments (i.e., assigning an artificially high SIO at a developed ski area would be unachievable, just as assigning an artificially low SIO would not incentivize the ski area to strive to minimize visual impacts).

As indicated in the 2002 Forest Plan, the project area (the Upper Mountain), is designated as *Very Low*.³³ However, small, isolated portions of the SUP area are designated as *Low*.

The *Very Low* SIO is defined as:³⁴

Deviations may strongly dominate the valued landscape character. They may borrow from valued attributes such as size, shape, edge effect and pattern of natural openings, changes in vegetation types, or architectural styles outside the landscape being viewed. However, deviations must be shaped by and blend with the natural terrain so that elements such as unnatural edges, roads, landings and structures do not dominate the composition.

The *Low* SIO is defined as:³⁵

The valued landscape character "appears moderately altered". Deviations begin to dominate the valued landscape character being viewed but they borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetative type changes or architectural styles outside the landscape being viewed. They should not appear as valued character outside the landscape being viewed but compatible or complimentary to the character within.

³³ SIO designations within the Beaver Creek SUP are depicted graphically in the Project File.

³⁴ USDA Forest Service, 1995

³⁵ Ibid.

The 2002 Forest Plan states that all NFS lands shall be managed to attain the highest possible scenic quality commensurate with other appropriate public uses, costs, and benefits.³⁶

Scenery Management System Distance Zones

Viewing distance is important in determining how change is perceived across a landscape. Distance zones are divisions of a particular landscape being viewed, and are used to describe the part of a characteristic landscape that is being inventoried or evaluated.

- Immediate Foreground: This zone begins at the viewer and extends to about 300 feet. Individual leaves, flowers, twigs, bark texture, and other details dominate this view.
- Foreground: This zone is usually limited to areas within 300 feet to 0.5 mile (not to exceed 0.5 mile) of the observer, but it must be determined on a case-by-case basis, as should any distance zoning. Generally, detail of landforms is more pronounced when viewed from within the foreground zone.
- Middleground: Alterations in the middleground (0.5 to 4 miles from the observer) are less distinctive. Texture is normally characterized by the masses of trees in stands or uniform tree cover.
- Background: This zone extends from middleground (minimum of 4 miles between the observer and the area being viewed) to infinity. Shape may remain evident beyond 10 miles, especially if it is inconsistent with other landscape forms. Beyond 10 miles, alteration in landscape character becomes obscure.

Forest Plan Standards and Guidelines

In addition to the SMS, the 2002 Forest Plan contains forest-wide standards and guidelines which apply to resources across the WRNF.³⁷ While the 2002 Forest Plan contains no forest-wide standards for scenery management, it offers the following guidelines that are applicable to this project:³⁸

- Management activities should be designed and implemented to achieve, at minimum, the level of scenic integrity shown on the Scenic Integrity Objective Map.
- Plan, design and locate vegetation manipulation on a scale that retains the color and texture of the landscape character, borrowing directional emphasis of form and line from natural features.

³⁶ USDA Forest Service, 2002a

³⁷ A *standard* is a course of action which must be followed; adherence is mandatory. A *guideline* is a preferred course of action designed to achieve a goal, respond to variable site conditions, or respond to an overall condition.

³⁸ USDA Forest Service, 2002a

- Choose facility and structure design, scale, color of materials, location and orientation to meet the scenic integrity objective on the Scenic Integrity Objective Map.
- Facilities, structures and towers with exteriors consisting of galvanized metal or other reflective surfaces will be treated or painted dark non-reflective colors that blend with the forest background to meet an average neutral value of 4.5 or less as measured on the Munsell neutral scale.

Management Area 8.25 standards and guidelines applicable to this project and the scenery resource include:

- Standard: Permanent outdoor advertising is not a needed public service and is not allowed.
- Guideline: Facilities are designed with an architectural theme intended to blend facilities with the natural environment.
- Guideline: Vegetation is retained to screen facilities from key viewpoints.
- Guideline: Roads are designed to minimize visual and resource impacts. They are constructed and maintained with good alignments and grades that minimize erosion.

Furthermore, the following information on the desired condition for scenic values is contained in Management Area 8.25:³⁹

Protection of scenic values is emphasized through application of basic landscape aesthetics and design principles, integrated with forest management and development objectives. Reasonable efforts are made to limit the visibility of structures, ski lifts, roads, utilities, buildings, signs, and other man-made facilities by locating them behind landform features or by screening them behind existing vegetation. Facilities are architecturally designed to blend and harmonize with the national forest setting as seen from key viewpoints. Facilities that no longer serve a useful purpose are removed.

The 2002 Forest Plan further states that it is a regional goal to “provide for scenic quality and a range of recreational opportunities that respond to the needs of the forest customers and local communities.”⁴⁰

The Built Environment Image Guide

The Built Environment Image Guide (BEIG) was prepared by the Forest Service for the “thoughtful design and management” of the built environment contained within the National Forests.⁴¹ The Forest

³⁹ Ibid.

⁴⁰ Ibid.

⁴¹ USDA Forest Service, 2001a

Service defines the built environment as “the administrative and recreation buildings, landscape structures, site furnishings, structures on roads and trails, and signs installed or operated by the Forest Service, its cooperators, and permittees.”⁴² The BEIG divides the United States into eight provinces which combine common elements from the ecological and cultural contexts over large geographical areas; the Beaver Creek SUP area and adjacent NFS lands are within the Rocky Mountain Province. Site development, sustainability, and architectural character should conform to BEIG guidelines described for this Province.

AFFECTED ENVIRONMENT

Beaver Creek’s existing lift and trail network, all related infrastructure, maintenance and guest operation buildings are currently consistent with the 2002 Forest Plan SIO designations (*Very Low* and *Low*) for the SUP, as well as Forest-wide guidelines for scenery management. Beaver Creek’s traditional, below tree-line trails are the major contributing factor to the *Very Low* SIO (“appears heavily altered”) classification for the developed portions of the SUP area.

Scenic Characteristics of Beaver Creek’s SUP Area

Developed winter recreation dominates the sense of place at Beaver Creek and in the town of Avon. The aesthetic landscape across private and NFS lands in the vicinity of Beaver Creek has been defined by recreation since the resort opened to the public in 1980, with the development of trails, lifts, infrastructure, and skier facilities on NFS lands evolving since that time. Roughly 1,570 acres of skiable terrain have been developed on NFS and private lands, with an additional 774 acres of glades.

Vegetation cover throughout the SUP area varies due to the broad range in elevation, slope aspect, and gradient. Plants that occur within the alpine zones (11,000 to 11,500 feet) and subalpine zones (9,000 to 11,500 feet) of Colorado characterize the SUP area. Dominant species include Engelmann spruce, lodgepole pine, sub-alpine fir, and aspen. The distinctive vegetation patterns typical of cut ski slopes contribute to the scenic character of Beaver Creek’s current operational boundary area. Lodgepole pine within and around the SUP area, primarily below 9,800 feet, continue to succumb to mountain pine beetle outbreak. This mortality is expected to continue to affect the scenic quality of Beaver Creek and surrounding NFS and private lands in the near future.

Developed skiing terrain within the SUP area occurs on 149 named trails. Beaver Creek’s SUP area is below tree line; therefore, the terrain network is primarily comprised of traditional trails that were cut within the forest canopy, with some glades (e.g., Royal Elk Glades) and naturally open areas (e.g., McCoy Park). With the exception of Larkspur, there are essentially no open bowls.

⁴² Ibid.

The elevation of I-70 and the Town of Avon is 7,400 feet. Beaver Creek Village (the ski area's main access portal) is approximately 700 vertical feet higher at 8,100 feet. The summit elevation (the top of the Cinch Express) is 11,440 feet. Although Beaver Creek's 16 aerial lifts and 148 trails are on northern, eastern and western aspects, the difference in elevation between Beaver Creek's base area and I-70, combined with natural topographic relief (i.e., a small mountain stands between I-70 Beaver Creek) minimize the visibility of the ski area to drivers on I-70. The lift and trail network on north and west facing aspects of the Upper Mountain (Cinch Express/Birds of Prey Express pods and Grouse Mountain) can only be perceived in the middleground/background distance zones to eastbound travelers on I-70. For westbound travelers, the view of Beaver Creek is limited.

Scenic Characteristics the Project Area

Individual project elements within the project area (the Upper Mountain) are discussed separately from the SUP area at large to provide the reader with specific information regarding the current visual characteristics of the project area in relation to the Proposed Action.

Existing Birds of Prey Men's Downhill Course

The existing *Birds of Prey* men's Downhill course begins at the top of *Zoom Room* (near the top of the Cinch Express, approximately 11,440 feet in elevation) and continues down 2,590 vertical feet on *Golden Eagle* to the finish at Red Tail Camp. *Zoom Room* and the upper portion of *Golden Eagle* contribute to the developed visual character of the Upper Mountain, but are barely distinguishable in the middleground/background views from I-70. The lower portion of the existing trails that make up the men's Downhill course are not visible from I-70.

Proposed Birds of Prey Women's Downhill Course

Similar to the existing men's *Birds of Prey* racecourse, the portion of the project area that is proposed for the women's Downhill course is located within the existing Birds of Prey lift/terrain pod. It would begin on *Flattops*, extending to upper *Peregrine* before moving into a currently undeveloped tree island on skier's left of the Birds of Prey Express. It would then reconnect with lower *Peregrine*, finishing at Red Tail Camp. As with the men's racecourse, the trails proposed to be used for the women's Downhill course contribute to the developed visual character of the Upper Mountain, but are barely distinguishable in middleground/background views from I-70. The lower portion of the existing trails that would make up the women's Downhill course are not visible from I-70.

Proposed Grouse Mountain Women's Giant Slalom Course

The women's Giant Slalom racecourse is proposed within the existing lift/trail network on Grouse Mountain. For the most part, it would utilize the existing *Raven Ridge* trail, requiring selective widening on the upper portions of the trail. Tree removal would be needed to create a connection between *Raven Ridge* and lower *Golden Eagle* so that the finish area at Red Tail Camp can be used. As with the men's and women's Downhill courses, the trails proposed to be used for the women's Giant Slalom course

currently contribute to the developed visual character of the Upper Mountain, but are barely distinguishable in the middleground/background views from I-70. The lower portion of existing trails that would make up the women's Giant Slalom course are not visible from I-70.

Red Tail Camp/Racecourse Finish Area

The entirety of Red Tail Camp, at the confluence of three lifts—Birds of Prey Express, Grouse Mountain Express, and Larkspur Express—has been graded in the past. This area is only visible from within the ski area (i.e., in the Immediate Foreground and Foreground views).

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

Under the No Action Alternative, no changes or modifications would be approved that would affect the scenic quality of the SUP area. As discussed under Existing Conditions, Beaver Creek's traditional, below tree-line trails are the major contributing factor to the *Very Low* SIO ("appears heavily altered") classification for the developed portions of the SUP area.

Under the No Action Alternative, developed and undeveloped portions of Beaver Creek's SUP area would continue to meet the SIO of *Very Low*.

Alternative 2 – Proposed Action

All racecourse and infrastructural projects proposed throughout the project area are within the existing lift and trail networks on Beaver Creek's Upper Mountain. Due to the existing developed visual character of the project area, and lack of critical viewpoints from which proposed projects could be perceived, implementation of Alternative 2 would represent an incremental and insignificant visual addition to the appearance of the Beaver Creek SUP. Aside from eastbound (and, to a lesser extent, westbound) travelers on I-70, the only other viewpoints are from within the ski area itself. Implementation of the project elements contained in the Proposed Action would not affect Beaver Creek's compliance with the SIO of *Very Low*.

To the casual observer traveling on I-70 (middleground/background viewpoints), the proposed racecourse projects within the Birds of Prey Express and Grouse Mountain Express lift/terrain pods would be indistinguishable from the existing trails. It is reasonable to assume that anyone viewing the project area from the foreground view (i.e., within the ski area) would expect to see lifts, trails and infrastructure. Even then, it would be difficult to distinguish elements of the Proposed Action from existing features.

Construction of new Alpine ski racing terrain and the installation of new snowmaking would result in temporary ground disturbance, which would be promptly revegetated. During construction and revegetation periods these activities would be evident in the Immediate Foreground and Foreground distance zones. However, only skiers actually see the project area in the foreground view. As revegetation

efforts mature over time (two-to-five years), these disturbances would ultimately return to a condition similar to the present.

Mitigation measures and PDF for Visual Resources would be applied, where appropriate, to minimize associated impacts to visual resources.

CUMULATIVE EFFECTS

Appendix A includes a list of past, present, and reasonably foreseeable future projects have been identified by the Forest Service as relevant from a cumulative effects context.

Temporal and Spatial Extent of Analysis

The spatial extent of the cumulative effects analysis is the Beaver Creek SUP area. The temporal bounds for this cumulative effects analysis extends from 1980, when Beaver Creek was constructed within the SUP area, into the foreseeable future, under the terms of its SUP.

Ground and Vegetation Disturbance

Incremental past, present, and reasonably foreseeable actions that have cumulatively affected, or could affect, scenery resources at Beaver Creek (primarily related to overstory vegetation removal) include:

- Beaver Creek Ski Area Forest Health Project (Decision Notice signed in September 2011). Approved hazard tree, salvage and regeneration treatments on 553 acres of lodgepole pine on National Forest lands within the special use permit boundary.
- 2010 Summer Improvements (Decision Memo signed in June 2010). Approved an outdoor wedding venue near Spruce Saddle and a children's ski trail from *Riperoo's Retreat* to *Cinch*, removing 0.5 acre of dead lodgepole.
- Beaver Creek Beetle Tree Salvage Project (Decision Memo signed in May 2009). Approved removal of 13 acres of dead and dying lodgepole along Chairs 6 and 12.
- 2008 Summer Improvements (Decision Memo signed in July 2008). Approved *Polar Plunge* gladed skiing, *Buckboard* Connector ski trail and the *Bachelor Gulch* beginner route for a total of 3.3 acres of dead and dying lodgepole removal as well as an Environmental Learning Center at Spruce Saddle.
- Stone Creek Trail Construction (Decision Notice signed in February 2006). Approved *Stone Creek* access/egress trail, including 2.5 acres of timber removal and earthwork.
- Vail/Beaver Creek Bug Trees (Decision Notice signed in August 2003). Approved treatment of beetle-infested trees throughout the SUP.

- Beaver Creek Winter Sports Site and Year Around Recreation Area, Environmental Analysis Report (Record of Decision signed in February 1976). Original authorization for development of a winter sports site on NFS lands.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Additional developed terrain and infrastructure in previously undisturbed portions of the SUP area would represent irretrievable effects to scenery resources, particularly in high elevation areas. However, this commitment of the scenery resource is not considered irreversible because facilities and lifts could be removed and, in time, the area could be reclaimed and revegetated, restoring its natural appearance.

D. SOCIAL AND ECONOMIC RESOURCES

SCOPE OF THE ANALYSIS

The scope of this analysis for social and economic resources summarizes the projected economic and fiscal impacts resulting from Beaver Creek hosting the 2015 World Alpine Ski Championships.

AFFECTED ENVIRONMENT

Eagle County has approximately 53,000 full-time residents with an additional 45,150 people residing in the community as second home owners.⁴³ As a vacation community, Eagle County's regional population fluctuates throughout the year, increasing at peak times during the ski season, such as the weeks around Christmas and spring break, as well as Presidents Day weekend.⁴⁴ This is primarily due to the community being populated by a mix of full-time residents, seasonal residents, and seasonal employees. Skier visitation at Beaver Creek is a factor in the overall growth of Eagle County, and has an influence on economic and social trends in the region. Short-term increases in local spending occur during the annual Birds of Prey World Cup race, which is typically held in early December.

Economy and Employment in Eagle County

The Colorado ski industry contributes approximately \$2.6 billion annually to Colorado's tourism industry, which is more than gaming, cultural events in Denver, and commercial river rafting combined.⁴⁵ Skier visits at Vail and Beaver Creek account for 20 percent of the total skier visits in Colorado.⁴⁶ During the 2010/11 ski season Colorado resorts hosted an estimated 12.3 million skier visits, which represents an increase of 3.7 percent compared to the prior season.⁴⁷ On a national level, the US ski industry recorded a record 60.5 million visits in 2010/11, up 0.1 percent from the previous record set during the 2007/2008 ski season. Within the Rocky Mountain region in 2010/11, resorts saw an increase of 2.6 percent over the previous ski season.⁴⁸

Skiing and tourism are Eagle County's major draws, as indicated by approximately 62 percent (or 5.8 million dollars) of the Town of Avon's estimated total tax revenue in 2011 will come from sales and accommodation tax collection.⁴⁹ Destination skiers are major contributors in this regard. In addition to generating revenue, the ski industry also supports Colorado's job market, providing approximately 31,000 jobs, or about 14 percent of all jobs related to the state's tourism industry. At the same time, as skier visits have declined since the economic downturn of 2008, the total number of jobs in Eagle County has also

⁴³ ULI, 2008

⁴⁴ LSC, 2003

⁴⁵ Denver Business Journal, 2008; Walsh, 2004

⁴⁶ Town of Avon, 2010

⁴⁷ Kottke, 2011

⁴⁸ Ibid.

⁴⁹ Town of Avon, 2010

declined. As of April 2011 the unemployment rate in Eagle County was 9.0 percent, more than double pre-recession numbers.⁵⁰

Economic Impact Estimates from Current Operations of Beaver Creek

Ski resort tourism spending plays an important role in the County's employment and income. In 2007, services, retail, and tourism related businesses were the sectors with the most employees with Vail Resorts Inc., the largest employer in Eagle County. Beaver Creek has averaged approximately 840,000 annual skier visits for the past ten years (refer to Chapter 3A – Recreation), stimulating employment at the ski area itself, as well as in areas such as lodging, restaurants, and retail throughout Eagle County. At the peak of the ski season Beaver Creek typically employs up to 2,500 people on-mountain (e.g., ski patrol, guest services, and lift operators). During the summer season only the Centennial Express and Spruce Saddle Lodge are operated and employment decreases to approximately 300 people.⁵¹ Since 2000, local resorts and towns in Eagle County have been marketing to attract visitors in the summer and shoulder seasons, resulting in an increase in summer lodging, meals, and entertainment spending.⁵² A system of over 37 miles of hiking, biking, equestrian and multiple use trails, scenic lift rides, and off-highway Jeep tours are among the recreational activities offered on the mountain for summer operations.

Notwithstanding the annual economic contribution of Beaver Creek to the local economy, Beaver Creek is home to the only annual men's World Cup stop in the United States. Beaver Creek's Birds of Prey racecourse hosts three days of ski racing including men's Downhill, Super G and Giant Slalom events. The event occurs in what is typically a slow time in the ski season –between Thanksgiving and Christmas, with approximately 20,000 people attending the three day event.⁵³ The majority of race activities are performed by volunteers, therefore little-to-no direct or indirect employment at Beaver Creek results from hosting the event. However, during the World Cup event, hotels, restaurants and local business in the Vail Valley (from East Vail to Edwards) are filled to near capacity with media members, spectators and athletes of the event. The direct economic impact is estimated at approximately \$1.8 to \$2.0 million; however, perhaps more significant than the direct economic effects of hosting a World Cup event is the media exposure Beaver Creek receives from the event, which is shown live during primetime in Europe.⁵⁴ Much of the World Cup publicity is focused at the European market to attract international ski-vacation visitors.

⁵⁰ US Bureau of Labor Statistics, 2011

⁵¹ Beaver Creek Resort, 2010

⁵² Vail Resort, 2007

⁵³ For clarity, one spectator is one individual attending one day of the event. Therefore, one individual could be counted multiple times should they attend multiple days.

⁵⁴ VVF, 2011

Economic Impact of Hosting the World Alpine Ski Racing Championships

Hosting a major sporting event has been found to have an extensive range of benefits within the local and regional economy surrounding the venue. These benefits include:

- Direct spending by the organization running the event on employees, infrastructure and promotion.
- Spending by attendees and visitors on lodging, transportation, food and shopping.⁵⁵
- Merchandising and sponsorship.
- Private investment in infrastructure.
- Long-term benefits, which include increasing exposure for the host of the event, as well as the region, which encourages future visitation to the resort or facility.

The World Alpine Ski Championships have been held in the Vail Valley twice previously—in 1989 and 1999. The economic impact from the 1989 World Alpine Ski Championships was estimated at \$54 million within the State of Colorado—75 percent of which was solely within Eagle County.⁵⁶

In 2001, RRC Associates was contracted to prepare a summary analysis of the economic impact of the 1999 World Alpine Ski Championships held between January 31st and February 11th 1999 at Vail and Beaver Creek. The purpose of the analysis was to better understand the long-term costs and benefits associated with hosting a major Alpine sporting event. RRC's goal was to provide both quantitative and qualitative information for local decision-makers as they prepared to host future World Alpine Ski Championships.⁵⁷ The analysis relied upon information collected from a number of sources, publicly available sales tax information from the State of Colorado, the Town of Vail and the Town of Avon, as well as information from Vail Resorts, the Vail Valley Foundation, the Vail Valley Tourism and Convention Bureau, and Colorado Ski County USA.

Major findings and observations from the report were:⁵⁸

- The short-term benefits/effects (visitor spending/traffic) were potentially balanced by long-term benefits (image of the resort).
- The amount spent to host the event was \$25,107,298.
- Existing infrastructure (e.g., race terrain) and knowledge gives Vail Resorts a unique position and advantage in terms of hosting future World Alpine Ski Championships.

⁵⁵ Coleman, no date; Greig & McQuaid, 2003

⁵⁶ VVF, 2011

⁵⁷ RRC Associates, 2001

⁵⁸ Ibid.

- Maintaining a world class image requires constant exposure. Hosting the 1989 and 1999 World Alpine Ski Championships reinforced Beaver Creek's association with the World Alpine Ski Championships and increased international exposure to Vail Resorts.

As discussed above, the primary source of tax revenue for towns in Eagle County is sales tax revenue. During the 1999 event, attendees were estimated to have spent over \$20 million within the state of Colorado, of that the majority (\$16 million) in the Vail Valley. RRC estimated that the total economic impact to the state of Colorado was approximately \$100 million through spending by organizers (e.g., labor, administration, products, security) and attendees as they traveled to and from the events (e.g., lodging, vehicle rental, food).⁵⁹

Beyond attendee spending, another important source of tax revenue is lodging and accommodation taxes. Hosting the 1999 event increased local occupancy rates from an average of 67 percent in 1998 to 84 percent in 1999 over the same time period in January/February. In comparing 1998 to 1999 for the two-week period of the World Alpine Ski Championships, sales receipts within the Vail Valley showed a small percentage of growth, whereas, Aspen, Steamboat and Breckenridge reported a 10 percent drop in sales receipts for that same time period.⁶⁰

Perhaps the most successful measure of the World Alpine Ski Championships came from the national and international exposure for Colorado as a premier ski destination from television coverage and marketing exposure. Domestically, there were over 22 hours of combined television coverage for the event through the national broadcasting networks NBC and ESPN. Worldwide, the World Alpine Ski Championships were covered by 12 national television networks providing over 350 hours of programming across the two-week event. As such, the World Alpine Ski Championships were viewed in over 31 countries by over 400 million people.⁶¹

In addition to the economic benefits, the World Alpine Ski Championships resulted in increasing community pride. A survey was developed in combination with RRC's economic analysis, which was distributed throughout the local business community. People responding to the survey indicated that a majority of the public felt that they would volunteer or attend future World Alpine Ski Championships with 96 percent responding there would be a long-term benefit to the local community from hosting the event.⁶²

A similar study was commissioned to determine the economic impact on the local economy of a large scale international sporting event, namely the FIS Alpine Ski World Cup in Levi, Finland in 2008.⁶³ This

⁵⁹ Ibid.

⁶⁰ Ibid.

⁶¹ VVF, 2011

⁶² Ibid.

⁶³ Swedish School of Sport and Health Sciences, 2007

study found that the event encouraged attendees to make repeat visits to the ski area and region with similar benefits to the local economy seen previously in the Valley.

Environmental Justice

In 1994, President Clinton issued Executive Order (EO) 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” to ensure such populations are not subject to disproportionately high levels of environmental risk.⁶⁴ EO 12898 provides that “each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.” EO 12898 makes it clear that its provisions apply fully to programs involving Native Americans.

Racial diversity has remained limited in Eagle County; 67.3 percent of the County’s population is white and 30.1 percent is Hispanic or Latino. Other groups, each contributing approximately 1 percent or less of the population in Eagle County, are: Black, American Indian and Alaska Native, Asian, Hawaiian and Pacific Islander, Other, and people of two or more races.⁶⁵

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

One of the core objectives of Beaver Creek’s 2010 MDP is: “Update mountain facilities and infrastructure related to ski racing to continue to provide world class venues for Alpine events.”⁶⁶ Alternative 1 does not include any projects that would accommodate that objective, nor would it address the purpose and need. With no infrastructural improvements, Beaver Creek would be unable to offer an Alpine ski racing venue that would be FIS compliant to host women’s Downhill, Slalom, Giant Slalom or Super G events. Therefore, the 2015 World Alpine Ski Championships would not be held at Beaver Creek.

Selection of the No Action Alternative would not affect Beaver Creek’s ability to host the annual *Birds of Prey* men’s World Cup event, and the economic benefits of the three-day event would be as described in the existing condition.

Environmental Justice

No low income or minority populations were identified as potentially being disproportionately affected in terms of social or economic issues. Therefore, no Environmental Justice issues related to the No Action Alternative were identified that warranted analysis or disclosure.

⁶⁴ 59 Federal Register 7629, 1994; *Disproportionately* is a generic term used to define the adverse effects of environmental actions that burden minority and/or low income populations at a higher rate than the general public.

⁶⁵ U.S. Census Bureau, 2011

⁶⁶ Beaver Creek Resort, 2010 p. 7

Alternative 2 – Proposed Action

Economic and Fiscal Impacts of Hosting the 2015 World Alpine Ski Championships

The 2015 World Alpine Ski Championships would include male and female skiers from over 70 nations competing over a two-week period in select Alpine disciplines. The 2015 World Alpine Ski Championships would also include more than 550 athletes, coaches and officials, approximately 1,800 members of the media, 2,000 volunteers, and 1,200 high profile international sponsors.⁶⁷ In addition, more than 50 countries will carry the television feed to more than one billion worldwide viewers. The estimated total onsite attendance over the entire two weeks (February 3 through 15) for the 2015 World Alpine Ski Championships would be approximately 120,000 attendees.⁶⁸ The greatest beneficiary of the 2015 World Alpine Ski Championships would be the local economy, as people attending the event book hotel rooms, eat at local restaurants and shop at local businesses. As previously mentioned, a majority of the local tax revenue comes from sales and accommodation tax collection.

The operations budget for the 2015 World Alpine Ski Championships would exceed \$50 million. Of this, over \$34 million would come from sources outside the Vail Valley community.⁶⁹ It is anticipated that the majority of this revenue would be spent with services and businesses in Eagle County. In addition, the cost for the television setup, services and production would exceed \$6 million and the majority of this would be spent in the Vail Valley.⁷⁰ As discussed above, the 1999 World Alpine Ski Championships were accompanied by a State of Colorado economic impact of \$100 million, with 75 percent being spent solely in Eagle County.⁷¹ Based on the economic impact to the local economy during the 1999 World Alpine Ski Championships, the Vail Valley Foundation conservatively estimates that the State of Colorado economic impact would be \$100 million, with 75 percent being specific to Eagle County.⁷²

One of the core objectives of Beaver Creek's 2010 MDP is: "Update mountain facilities and infrastructure related to ski racing to continue to provide world class venues for Alpine events."⁷³ Hosting the 2015 World Alpine Ski Championships would be consistent with this objective and would increase Beaver Creek's visibility on the international stage by allowing the resort to market itself to an international clientele. Although Beaver Creek's place on the World Cup circuit provides an avenue to spotlight the resort on the international and domestic stage, the media coverage associated with hosting the 2015 World Alpine Ski Championships would allow the resort to increase marketing exposure abroad.

⁶⁷ Imhof, 2011

⁶⁸ Note: this does not assume 120,000 individuals. This accounts for 30,000 individuals who are expected to attend multiple days of Alpine racing events across the two-week period. For clarity, one individual is counted as an attendee each day that person attends the event.

⁶⁹ VVF, 2011

⁷⁰ Ibid.

⁷¹ RRC Associates, 2001

⁷² VVF, 2011

⁷³ Beaver Creek Resort, 2010 p. 7

Employment

The 2015 World Alpine Ski Championships would be primarily administrated by a volunteer workforce. During the 13-day event approximately 2,000 volunteers would be utilized for spectator management, parking direction, etc. Construction of principal project components included in Alternative 2 (e.g., trails, snowmaking infrastructure, and Red Tail Camp) would occur over one or more construction seasons resulting in a short-term, seasonal increase in employment in Eagle County. The project would be completed by local contractors and Beaver Creek employees, where appropriate. New trail development and construction of guest service facilities would occur in the summer of 2012 or 2013, while setup for the new Red Tail Camp Finish Stadium, snowmaking/grooming, and arena setup would occur mid-winter of 2015 prior to the event.⁷⁴ Construction related employment is not anticipated to generate any significant change in local area population or housing growth trends. No significant secondary and/or induced employment related to construction projects is anticipated.

Due to the large number of volunteers which would be utilized for the event, direct, seasonal employment at Beaver Creek is not anticipated to measurably increase at the county scale as a result of the proposed improvements or by hosting the two week event. Indirect seasonal employment (e.g., restaurants, hotels etc.) within the local economy is likely to increase as businesses increase short-term employment in order to accommodate the anticipated 120,000 attendees during the event.

Environmental Justice

As indicated in the No Action Alternative, no low income or minority populations were identified as potentially being disproportionately affected in terms of Environmental Justice issues. Therefore, no Environmental Justice issues related to the Proposed Action were identified that warranted analysis or disclosure.

CUMULATIVE EFFECTS

Appendix A includes a list of past, present, and reasonably foreseeable future projects have been identified by the Forest Service as relevant from a cumulative effects context.

Temporal and Spatial Extent of Analysis

The spatial extent of the cumulative effects analysis is the Beaver Creek SUP area. The temporal bounds for this cumulative effects analysis extends from 1988, when Beaver Creek first held the World Alpine Skiing Championships, into the foreseeable future in which Beaver Creek is expected to continue to host annual World Cup events.

⁷⁴ Johnson, 2011

Alpine Ski Racing at Beaver Creek

The Forest Service's approval for Beaver Creek in 1976 led to the establishment of the ski area as a prominent year-round recreational venue. From an economic standpoint, this has greatly contributed to the economy of Eagle County. In the future, Beaver Creek will continue to host the *Birds of Prey* World Cup event, which represents an annual, short-term stimulus to the local economy.

With implementation of projects contained in Alternative 2, Beaver Creek could potentially host more Alpine racing events in the future, which would have tangible economic impacts to Eagle County, and perhaps Colorado. However, beyond the annual World Cup events and the 2015 World Alpine Ski Championships, future Alpine events being held at Beaver Creek are purely speculative and cannot be accounted for in this analysis.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

No irreversible and/or irretrievable commitment of social or economic resources has been identified in association with any of the alternatives analyzed in this document.

E. AIR QUALITY

SCOPE OF THE ANALYSIS

This air quality analysis focuses on the Beaver Creek SUP area (NFS lands), and areas proximate to Beaver Creek on private lands. The analysis primarily focuses on Alpine ski racing, which occurs as short-duration, annual events. These include the annual Birds of Prey World Cup races and the upcoming 2015 World Alpine Ski Championships. The annual *Birds of Prey* World Cup event is held over a period of three days, typically in early December, while the 2015 World Alpine Ski Championships are planned over a 13-day period in February. Therefore, due to the nature of the Proposed Action, this analysis focuses on short-term increases in vehicle emissions associated with increased athlete, spectator and media capacity for Alpine ski racing events.

REGULATORY DIRECTION

The goal for air quality on NFS lands in Colorado is to manage emissions generated in or near Federal land management areas such that air quality will meet the National Clean Air Act and Colorado State air quality requirements. Specific requirements can be found in the Forest Service Air Quality Program, Colorado Smoke Management Program Memorandum of Understanding (SMP MOU), and Colorado Air Quality Control Commission Regulation No. 9.⁷⁵ In addition, National Ambient Air Quality Standards (NAAQS) for particulate matter (PM₁₀) and the Prevention of Significant Deterioration (PSD) Total Suspended Particulate (TSP) increment for Class 1 and 2 areas must be met.

Forest Service direction regarding air resources is found in the Forest Plan for the WRNF. No specific air quality related standards or guidelines have been promulgated for the 8.25 Management Area; however, Forest-wide standards require that activities “[c]omply with local, state, and federal air quality regulations and maintain conformity with the State Implementation Plan.”⁷⁶ Ski area projects on NFS lands should be designed to meet state and federal standards, or employ mitigation to meet these regulations.

Applicable Air Quality Regulations

Federal

The Clean Air Act (CAA) was enacted in 1963, but it contained few requirements for reducing air pollutant emissions. It was amended numerous times through 1990 to address reductions in vehicular and stationary source emissions and to establish national air pollution concentration limits. It also established several programs, including: NAAQS, which limited air concentrations to protect public health and welfare; the New Source Performance Standards, which set emission standards for major sources; and the State Implementation Plan (SIP) procedures, which were designed to bring areas that exceeded NAAQS levels (non-attainment areas) to within the standards. In addition, the PSD program was established to

⁷⁵ USDA Forest Service, 2000c

⁷⁶ USDA Forest Service, 2002a

help protect attainment areas of the country (Class 1 and 2 areas). The PSD Class 2 designation allows for moderate growth or degradation of air quality within certain limits above baseline air quality. The PSD program also included protection of National Parks, and Wilderness areas greater than 10,000 acres (Class 1 areas). Finally, the PSD program established visibility impairment restrictions on major sources impacting the Class 1 areas.

Table 3E-1 lists the National Ambient Air Quality Standards.

**Table 3E-1:
National Ambient Air Quality Standards for Criteria Pollutants**

Pollutant	Primary Standards^a	Averaging Times	Secondary Standards
Carbon Monoxide	9 ppm (10 mg/m ³) 35 ppm (40 mg/m ³)	8-hour ^b 1-hour ^b	None None
Lead	0.15 µg/m ³ 1.5 µg/m ³	Rolling 3-month Average Quarterly Average	Same as Primary Same as Primary
Nitrogen Dioxide	0.053 ppm (100 µg/m ³) 0.100 ppm	Annual (Arithmetic Mean) 1-hour ^h	Same as Primary
Particulate Matter (PM) PM ₁₀ PM _{2.5}	150 µg/m ³ 15.0 µg/m ³ 35 µg/m ³	24-hour ^{bc} Annual ^d (Arithmetic Mean) 24-hour ^e	Same as Primary Same as Primary Same as Primary
Ozone	0.075 ppm (2008 std) 0.08 ppm (1997 std)	8-hour ^g 8-hour ^f	Same as Primary Same as Primary
Sulfur Dioxide	0.075 ppm	24-hour ⁱ 3-hour ^b	0.5 ppm (1300 µg/m ³)

^a ppm = parts per million, µg/m³ = micrograms per cubic meter, mg/m³ – milligrams per cubic meter

^b Not to be exceeded more than once per year.

^c 3-year average of the weighted annual mean PM₁₀ concentration at each monitor within an area must not exceed 50 µg/m.

^d 3-year average of the weighted annual mean PM_{2.5} concentrations from single or multiple community-oriented monitors must not exceed 15.0 µg/m.

^e 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 65 µg/m.

^f 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

^g 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm.

^h 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 0.100 ppm.

ⁱ 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years

Source: U.S. Environmental Protection Agency. 2009a. Air and Radiation: National Ambient Air Quality Standards (NAAQS). <http://www.epa.gov/air/criteria.html>. Accessed January 10, 2012.

The CAA designates two different air quality areas that receive different levels of protection. Class 1 areas generally include national parks, federally-designated wilderness areas that are in excess of 5,000 acres and that were created prior to 1977, national monuments, national seashores, and other areas of special national or regional value. Class 1 designation warrants the highest level of protection afforded to an area. Class 2 designation typically applies to non-Class 1 areas. The only Class 1 airsheds close to the

project area is the Eagle's Nest Wilderness area (approximately 8 miles to the north) and the Holy Cross Wilderness area located approximately 2 miles to the south.

Class 1 and 2 areas are either designated as attainment, non-attainment, or unclassifiable areas. Unclassifiable designations apply where pollution is not anticipated to exceed national standards and where insufficient information is available to either substantiate or reject this assumption. Unclassified areas generally have little, if any, industrial development and comparatively sparse populations. The low likelihood of air quality problems makes these areas a lower priority for expensive monitoring programs.

In addition to the NAAQS discussed above, the EPA has promulgated regulations to protect and enhance air quality. The PSD regulations are intended to help maintain good air quality in areas that attain the national standards and to provide special protections for national parks, federally designated wilderness areas, national monuments, national seashores, and other areas of special national or regional natural, recreational, scenic, or historical value.⁷⁷ These regulations stipulate that new sources must not cause a decline in ambient air quality and must use best available control technology to limit emissions.

PSD permits are required for, "major emitting facilities" which emit, or have the potential to emit, 100 tons or more per year of any air pollutant.⁷⁸ EPA regulations specifically list the sources that are considered "major emitting facilities"—this list does not include ski areas.⁷⁹ However, the regulations note that the term "major emitting facilities" also includes "any other source with the potential to emit 250 tons per year or more of any air pollutant."⁸⁰ A PSD permit is not required for Beaver Creek because ski areas are not classified as stationary sources and Beaver Creek does not have the potential to emit over 250 tons of any regulated air pollutant.

In an effort to eliminate or minimize the severity and number of exceedances of the NAAQS and to achieve expeditious attainment of these standards, the EPA promulgated the Conformity Rule in 1993. Conformity regulations apply to federal actions and environmental analyses in non-attainment areas completed after March 15, 1994. The conformity regulations do not apply to Eagle County or to the Beaver Creek area because they are classified as attainment areas or as unclassifiable for all criteria pollutants.

Mobile Source Air Toxics Regulations

As Stated in 40 CFR Parts 59, 80, 85 and 86 Control of Hazardous Air Pollutants from Mobile Sources:

Mobile source air toxics (MSATs) are compounds emitted from highway vehicles and non-road mobile equipment (e.g., construction equipment). Some of these toxic

⁷⁷ 42 USC 7470-7479

⁷⁸ 42 USC 7475[a] and 7479[1]

⁷⁹ 42 USC 7479[1]

⁸⁰ Ibid.

compounds are present in fuel and are emitted to the air when the fuel evaporates or passes through the engine unburned. Other toxics are emitted from the incomplete combustion of fuels or as secondary combustion products. Metal air toxics also result from engine wear or from impurities in oil or gasoline. The EPA has identified six priority MSATs: benzene, formaldehyde, acetaldehyde, diesel particulate matter/diesel exhaust organic gases, acrolein, and 1,3-butadiene.

The EPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The EPA Integrated Risk Information System (IRIS) is a database of human health effects that may result from exposure to various substances found in the environment. The IRIS database is located at <http://www.epa.gov/iris>. The following toxicity information for the six prioritized MSATs was taken from the IRIS database *Weight of Evidence Characterization* summaries. This information is taken verbatim from EPA's IRIS database and represents the Agency's most current evaluations of the potential hazards and toxicology of these chemicals or mixtures.

Benzene is characterized as a known human carcinogen for all routes of exposure based upon convincing human evidence as well as supporting evidence from animal studies.

Formaldehyde is a probable human carcinogen, based on limited evidence in humans, and sufficient evidence in animals.

Acetaldehyde is a probable human carcinogen based on increased incidence of nasal tumors in male and female rats and laryngeal tumors in male and female hamsters after inhalation exposure.

Diesel exhaust (DE) is likely to be carcinogenic to humans by inhalation from environmental exposures. Diesel exhaust as reviewed in this document is the combination of diesel particulate matter and diesel exhaust organic gases.

Diesel exhaust also represents chronic respiratory effects, possibly the primary noncancer hazard from MSATs. Prolonged exposures may impair pulmonary function and could produce symptoms, such as cough, phlegm, and chronic bronchitis. Exposure relationships have not been developed from these studies.

The potential carcinogenicity of **acrolein** cannot be determined because the existing data are inadequate for an assessment of human carcinogenic potential for either the oral or inhalation route of exposure.

1,3-butadiene is characterized as carcinogenic to humans by inhalation.

The EPA has issued a number of regulations that will significantly decrease MSATs by requiring the use of cleaner fuels and cleaner engines. The MSAT regulations were issued under the authority in Section 202 of the Clean Air Act. In its regulations, EPA examined the impacts of existing and newly

promulgated mobile source control programs, including the reformulated gasoline program, national low emission vehicle standards, Tier 2 motor vehicle emissions standards, gasoline sulfur control requirements, proposed heavy-duty engine and vehicle standards, and on-highway diesel fuel sulfur control requirements.⁸¹

State

The EPA retains oversight authority but has delegated enforcement of the CAA to the states. In Colorado, the Air Pollution Control Division of the Department of Public Health and Environment acts as the lead agency. The state is required to develop and administer air pollution prevention and control programs; state standards must be either the same as, or more stringent than, Federal CAA standards. In Colorado, the state has adopted all federal ambient air quality standards as reflected in the CAA with an additional particulate standard; the standard for total suspended particulate emissions is 75 micrograms/cubic meter over 24 hours and 260 micrograms/cubic meter annually.

AFFECTED ENVIRONMENT

Climate

Eagle County experiences a typical mid-continental, high-elevation climate with cool summers and cold winters. Humidity is low and diurnal temperature fluctuations are high. Prevailing winds are generally from the southwest, west, and west-northwest, and the region receives the majority of its precipitation from Pacific storms.⁸² Precipitation is generally higher in the winter than in the summer. Winter precipitation occurs as abundant snowfall, while summer precipitation often occurs as localized thunderstorms. Wind speeds on the mountain are generally higher than winds experienced within lower elevations of the Vail Valley. Within the Valley, lower wind speeds can reduce dispersion, which could potentially increase the likelihood of temperature inversions in the area.

The Eagle's Nest Wilderness Area, the only Class I airshed near the project area, is downwind of several major emitters, including seven coal power plants in Colorado and Utah, as well as some minor emitters. Lacking baseline testing, the effect of these emissions is unknown. Due to prevailing wind direction, west, southwest and south, Eagle's Nest Wilderness Area is sheltered from most pollutant sources.⁸³

Because average wind direction as measured at Beaver Creek is predominantly from the west, it is unlikely that any emissions generated directly or indirectly by Beaver Creek's operations currently affect the Holy Cross Wilderness.⁸⁴

⁸¹ 40 CFR 59, 80, 85 and 86

⁸² USDA Forest Service, 1998

⁸³ Ibid.

⁸⁴ CDOT, 2004

NAAQS Pollutants

Eagle County has not monitored, and is not currently monitoring, SO₂, CO, O₃, Pb, NO₂, or PM_{2.5}. It is believed that the probability of these pollutants becoming an impediment to attainment is unlikely. This, combined with the expense of monitoring, has made it impracticable to oversee these pollutants.

However, due to existing regulations, climate, and topography, future exceedances of NAAQS would be unlikely. It is probable that Eagle County would continue to be classified as an attainment area for all monitored criteria pollutants and no additional air quality issues would be anticipated. Incremental increases in emissions would be unlikely to violate PSD regulations for criteria pollutants.

Greenhouse Gas Emissions and Carbon Dioxide

Emissions which contribute to climate change are called greenhouses gases (GHG), as they allow more solar radiation in at the upper atmospheres and trap heat in the lower atmosphere. The primary GHGs are carbon dioxide (CO₂), O₃, methane (CH₄), and nitrous oxide (N₂O). Natural sources of CO₂ occur within the carbon cycle where billions of tons of atmospheric CO₂ are removed from the atmosphere by oceans and growing plants, also known as ‘sinks,’ and are emitted back into the atmosphere annually through natural processes also known as ‘sources.’

GHG discussions generally focus on CO₂, as it constitutes approximately 85 percent of all GHG emissions worldwide. Within the United States, fossil fuel combustion accounted for approximately 94.1 percent of CO₂ emissions in 2008. The largest source of these CO₂ emissions was from the burning of fossil fuels such as coal, oil and gas in power plants, automobiles, industrial facilities, and other sources.⁸⁵ The transportation sector directly accounted for about 28 percent of total United States GHG emissions, making it the second largest source of GHG emissions, behind electricity generation (34 percent). Globally, approximately 30,377 Teragrams (Tg) of CO₂ (1 teragram = 1,000,000 metric tons) were added to the atmosphere through the combustion of fossil fuels in 2008, of which the United States accounted for about 19 percent.⁸⁶

GHG Contribution of Beaver Creek Guests and World Cup Attendees

It is not currently possible to accurately discern the effects of Beaver Creek from the effects of all other GHG sources worldwide, nor is it expected that attempting to do so would provide a practical or meaningful analysis of project effects. However, by developing assumptions related to traffic created by guests and attendees accessing facilities at Beaver Creek it is possible to estimate the GHG emitted by existing vehicular traffic produced by visitors accessing facilities at Beaver Creek during the winter operating season and by attendees at the annual *Birds of Prey* World Cup races. The assumptions were related to the origin of guests and attendees (e.g., Denver), and the number of guests and attendees who

⁸⁵ US EPA, 2010

⁸⁶ US Energy Information Administration, 2009

utilize lodging. For example, approximately 80 percent of Beaver Creek's visitors are destination (both regional and national/international) guests and either arrive by plane at Denver International Airport or drive from within or outside Colorado. The remaining 20 percent are assumed to be day skiers who reside within a three-hour driving radius.⁸⁷ The detailed quantification is located in the Project File. From Denver International Airport, guests typically either use a shuttle service or rent a car for the approximately two-hour drive to the mountains. Many destination guests stay within the Town of Avon or at lodging adjacent at Beaver Creek and only drive to and from the resort at the beginning and end of their vacation. It is acknowledged that other sources of GHG emissions are present at Beaver Creek (e.g., grooming equipment, emissions associated with heating and cooking fuels, and snowmobiles); however, the majority of GHG emissions are produced by vehicle trip generation specific to the use of the ski area.

Discussed above, GHG emissions include a variety of compounds, most notably CO₂, CH₄, and N₂O. However, for on-road tailpipe emissions, CO₂ is by far the most significant contributor to GHG emissions. For purposes of comparing GHG emissions, the overall GHG emissions associated with Beaver Creek's existing guests are assumed to consist entirely of CO₂. The CO₂ emissions were calculated from the fuel usage of vehicles traveling to and from Beaver Creek, based on the average fuel economy data (i.e., miles per gallon of fuel) published by the EPA.⁸⁸ Since not all visitors to Beaver Creek stay overnight, a percentage of these visitors were assumed to travel round-trip each day from the Front Range or other mountain communities. The CO₂ emission factors (e.g., CO₂ emitted per gallon of gasoline burned) were then applied to the calculated total fuel usage to get the CO₂ emissions emitted from motor vehicles traveling to utilize Beaver Creek facilities. The detailed quantification is located in the Project File.

Based on the above assumptions and using the actual 2010/2011 visitation at Beaver Creek (i.e., 899,721), it is estimated that GHG emissions currently generated by Beaver Creek visitors contributed approximately 16,034 metric tons CO₂ equivalent (CO₂e) during the 2010/11 ski season, or approximately 115 metric tons CO₂e/day, to the local and regional environment.⁸⁹ Similarly, using attendance figures for the 2010 *Birds of Prey* World Cup event (e.g., approximately 20,000 attendees, 300 volunteers, 150 athletes, 300 media members), it is estimated that the *Birds of Prey* World Cup event contributes approximately 414.5 metric tons CO₂ equivalent (CO₂e) during the three-day event or 138.2 metric tons CO₂e/day. For clarity, this calculation includes motor vehicle emissions generated by Beaver Creek

⁸⁷ The ratio of 80 percent destination and 20 percent day skiers/event spectators is based on information furnished by Vail Resorts.

⁸⁸ EPA Office of Transportation and Air Quality developed *Emission Facts: Average Carbon Dioxide Resulting from Gasoline and Diesel Fuel*, 2005, to ensure consistent assumptions and practices in the calculation of emissions of greenhouse gases from transportation and mobile sources. It is intended to be used as a reference for estimating emissions from mobile sources. Based on this fact sheet, a gallon of diesel fuel emits approximately 22.2 lbs CO₂. A gallon of gasoline emits approximately 19.4 lbs CO₂.

⁸⁹ "CO₂e is a metric used to compare the emissions from various greenhouse gases based upon their global warming potential." (EPA, 2011)

guests and *Birds of Prey* World Cup attendees as they drive from the Denver metropolitan area or other origination points to visit Beaver Creek.

The average fuel economy was based on the EPA average for passenger cars and light duty trucks. The assumed fleet average was 20.4 miles per gallon.⁹⁰ It is important to note that future fleet-average fuel economy will improve as new Corporate Average Fuel Economy (CAFE) standards are enacted. The Energy Independence and Security Act signed into law on December 19th, 2007, mandates a 40 percent increase in fleet-average fuel economy by 2020, equal to 35 miles per gallon.⁹¹

Air Quality Monitoring

Air Pollution Control Measures in Eagle County

Eagle County highly values good air quality and remains in attainment by being proactive. Air quality testing during the 1970s and 1980s showed air quality in Eagle County was better than the established standards. In 1990 the County implemented regulations restricting wood burning devices in new construction to one per unit, and requiring new devices to meet or exceed emission standards from the EPA for new technology. Open burning and ground disturbing development requires permitting as well as controls and abatement plans. Eagle County transit (ECO Transit) provides public mass transit commuting opportunities. Additionally, an Air Quality Forum was established to include the mining industry and local governments to develop higher standards for Eagle County air quality.⁹²

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Greenhouse Gas Emissions

Because greenhouse gases from vehicle emissions mix readily into the global pool of greenhouse gases, it is not currently possible to accurately discern the effects of the Beaver Creek's operations under Alternative 1 or 2 from the effects of all other greenhouse gas sources worldwide, nor is it expected that attempting to do so would provide a practical or meaningful analysis of project effects. Currently, the Forest Service does not have a standard tool for measuring greenhouse gas emissions. However, the EPA has provided guidance on how to calculate GHG emissions related to mobile sources, this guidance was used to determine the impact of the anticipated increase in vehicle trips associated with Beaver Creek's operations and spectator events. It is important to note that it is impossible to measure the incremental cumulative impact on global climate from emissions associated with Beaver Creek's existing and planned operations and activities.

⁹⁰ In 2007, the weighted average combined fuel economy of cars and light trucks combined was 20.4 miles per gallon. (FHWA, 2008)

⁹¹ Pub. L. 110 – 140 Energy Independence and Security Act of 2007

⁹² CDPHE, 2007

Based on the assumptions described above, the estimated GHG emissions generated by Beaver Creek visitors/attendees for Alternatives 1 and 2 are presented below in Table 3E-2.

Table 3E-2:
CO₂e Generated by the Alternatives

	Average Daily Visitation (e.g., Attendees)	Average Daily Metric Tons CO₂e^a	Total Estimated Metric Tons CO₂e Emitted During the Event
Existing Condition	6,917	138.2	414.5
Alternative 1 ^b	6,917	138.2	414.5
Alternative 2 ^{c,d}	10,085	207.0	2,690.7

^a The ratio of carbon dioxide emissions to total emissions (including carbon dioxide, methane, and nitrous oxide, all expressed as carbon dioxide equivalents) for passenger vehicles was 0.977 (EPA 2009)

^b Alternative 1 would not result in an increase in the daily guest capacity of Beaver Creek, therefore the estimated CO₂e is directly related to the three days that the annual *Birds of Prey* World Cup event would be held.

^c Alternative 2 would not result in an increase in the daily guest capacity of Beaver Creek; therefore the predicted increase in CO₂e is directly related to the 13-days that the 2015 World Alpine Ski Championships would be held.

^d Assumes 120,000 attendees, 5,000 supporters, 1,200 sponsors, 1,800 media members, 1,100 athletes/coaches

Alternative 1 – No Action

Under the No Action alternative, no new projects would be implemented at Beaver Creek. GHG emissions and air quality impacts would be associated with maintaining existing operations, including the lifts and ski trail network and associated infrastructure. No project related changes would occur to the current trends in air quality. Ongoing commercial and residential growth within Eagle County would continue independently of activities at Beaver Creek. Because there would be no new projects approved under Alternative 1, the 2015 World Alpine Ski Championships could not be held at Beaver Creek.

The annual *Birds of Prey* men's World Cup event would continue to be held over a 3-day period, typically in early December. In total, attendees, media and volunteers for the annual *Birds of Prey* World Cup event would be expected to contribute approximately 414.5 metric tons of CO₂e or 138.2 metric tons of CO₂e per day, as described in the existing condition. For comparison, the EPA estimates that the average annual household emissions in the United States are approximately 11.3 metric tons CO₂e.⁹³

Due to existing regulations, climate, and topography, future exceedances of NAAQS would be unlikely. It is probable that Eagle County would continue to be classified as an attainment area for all monitored criteria pollutants and no additional air quality issues would be anticipated. Incremental increases in emissions would be unlikely to violate PSD regulations for criteria pollutants.

Any change in emissions at Beaver Creek would be extremely unlikely to adversely affect air quality in the Eagle's Nest, Holy Cross, or Ptarmigan Wilderness areas. The Holy Cross Wilderness Area is upwind of Avon during the predominant south and southwest winds and associated Class I airshed. Beyond the

⁹³ Environmental Law Resource, 2010

scope of this project, new CAFE vehicle standards will continue to make progress toward the effort of introducing more fuel efficient vehicles to reduce greenhouse gas emissions and help reduce carbon monoxide and ozone pollutants in the project area.

Alternative 2 – Proposed Action

Historically, major international Alpine racing events in the United States have been rare, and aside from the Lake Placid, Squaw Valley, and, more recently, the Salt Lake City Olympics, there are few events to use as direct comparisons. Therefore, the most logical events to use for estimating attendance during the event and the origin of spectators at the 2015 World Alpine Ski Championships are the annual World Cup Alpine races that Beaver Creek hosts and the 1999 World Alpine Ski Championships hosted by Vail/Beaver Creek. Therefore, for purposes of this analysis it is anticipated that approximately 80 percent of Beaver Creek's visitors during the 2015 World Alpine Ski Championships would be destination (both regional and national/international) guests and would either arrive by plane at Denver International Airport or drive from within or outside Colorado. The remaining 20 percent are assumed to be day skiers who reside within a three-hour driving radius. This ratio is similar to the visitation pattern observed during the annual *Birds of Prey* World Cup event.

Using EPA data for CO₂ emitted per gallon of diesel fuel or gasoline, it is possible to estimate the CO₂e contribution of attendees, event volunteers, members of the media and athletes during the 13 days that Beaver Creek could host the 2015 World Alpine Ski Championships. The detailed quantification is located in the project file.

The 2015 World Alpine Ski Championships are anticipated to generate a total of 120,000 attendees across 13 days of racing, in addition to pre- and post-race periods. For the purposes of this analysis, "attendees" (which include all individuals who are in attendance across multiple days of the event, totaling 39,100) are defined as:

- 550 athletes;
- 550 team supporters;
- 1,800 members of the media;
- 1,200 sponsors;
- 5,000 supporters (industry and team members who travel to major events in support of their Federation and sport); and
- 30,000 attendees.

Based on the above assumptions, it is estimated that GHG emissions expected to be generated during the 13-day 2015 World Alpine Ski Championships would total approximately 2,690.7 metric tons CO₂e, or 207.0 metric tons CO₂e/day. For comparison, the daily contribution (over three days) from attendees and

other attendees of the annual *Birds of Prey* World Cup event at Beaver Creek has been calculated at approximately 138.2 metric tons CO₂e per day—a difference of 68.8 metric tons.

Implementation of Alternative 2 would include improvements to race terrain and the finish area, an expansion of the Red Tail Camp restaurant and updating infrastructure. Construction of these facilities would generate fugitive dust. Dust emissions would be generated primarily by wind blowing over exposed soil surfaces during grading, scraping, and movement of construction equipment and support vehicles around construction sites and staging areas.

Similar to Alternative 1, due to existing regulations, climate, and topography, future exceedances of NAAQS under Alternative 2 would be unlikely. It is probable that Eagle County would continue to be classified as an attainment area for all monitored criteria pollutants and no additional air quality issues would be anticipated. Incremental increases in emissions would be unlikely to violate PSD regulations for criteria pollutants.

Fugitive dust emissions are generally the largest source of PM₁₀ during construction. Emissions depend on soil type, soil moisture content, and the total area of soil disturbance. Dust emissions attributable to construction activities are not considered significant because they would be temporary and would not occur within a designated PM₁₀ or PM_{2.5} non-attainment area. During the summer construction period, construction equipment would be an undefined low-level emission source of short-term air pollutants. Best management practices (BMPs) would be utilized to reduce fugitive emissions for implementation of any ground disturbing projects.

Construction equipment powered by internal combustion engines would generate NO₂, reactive organic gases, odors, SO₂, CO, and PM₁₀. Detailed construction schedules and knowledge of the type, number, and duration of heavy equipment operations are necessary to accurately quantify construction-related emissions. This information is not yet available for this FEIS. However, air quality impacts caused by construction equipment emissions would be short-term, occurring only when construction activities are taking place, and would have a minor impact on overall air quality. Additionally, BMPs would be employed to remain in compliance with local, state, and federal air quality regulations, particularly during construction to minimize impacts to air resources (see Table 2-1).

Trees felled during implementation of Alternative 2 would be disposed of via a combination of removal of merchantable timber or on-site burning. Burning may be accomplished by using a trench burner, or through the use of an air curtain incinerator. An air curtain incinerator is a large metal container or pit that burns fuels with the aid of a powerful fan-like device to force additional oxygen into the combustion process resulting in a very hot and efficient fire that produces little smoke. This method is commonly used in areas sensitive to smoke and frequently required by air quality agencies nationwide. Although there would be localized short term air quality effects due to the burning of wood debris, the effects are

anticipated to be greatly reduced due to the efficient burn method used for disposal and would cease once the debris has been completely incinerated.

CUMULATIVE EFFECTS

Appendix A includes a list of past, present, and reasonably foreseeable future projects have been identified by the Forest Service as relevant from a cumulative effects context.

Temporal and Spatial Extent of Analysis

The spatial extent of the cumulative effects analysis is the Beaver Creek SUP area. The temporal bounds for this cumulative effects analysis extends from 1988, when Beaver Creek first held the World Alpine Skiing Championships, into the foreseeable future in which Beaver Creek is expected to continue to host annual World Cup events.

Past Projects in Eagle County

Past actions that have impacted air quality in Eagle County include: development of Vail Ski Area in 1962 (and subsequent expansions over the decades); development of Beaver Creek in 1980; forest management activities; population changes within Eagle County; and construction of, and increased traffic on, the I-70 corridor. Residential and commercial growth within the Vail Valley (both related and unrelated to Vail and Beaver Creek ski area), and associated traffic, are larger impacts air quality than direct impacts associated with ski area projects.

As a result of implementation of Alternative 2, Beaver Creek could potentially host more Alpine racing events in the future. However, beyond the annual World Cup events and the 2015 World Alpine Ski Championships, future Alpine events being held at Beaver Creek are purely speculative and cannot be accounted for in this analysis.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

No irreversible and/or irretrievable commitments of resources in relation to air quality have been identified in association with either alternative analyzed in this document.

F. WILDLIFE

SCOPE OF THE ANALYSIS

The following is a summary of detailed wildlife analyses prepared for this project—all of which are contained in the project file. These include:

- A Biological Assessment (BA) that evaluates potential project effects on federally endangered, threatened, and proposed species;
- A Biological Evaluation (BE) that evaluates potential effects on Region 2 sensitive species and federal candidate species; and
- A Management Indicator Species (MIS) analysis that addresses potential impacts to select WRNF MIS.

Forest Service Manual 2670 provides direction on the review, actions, and programs authorized, funded or implemented by the Forest Service relative to the requirements of the Endangered Species Act (ESA). Under ESA, the Forest Service is required to undergo Section 7 consultation with the U.S. Fish and Wildlife Service (USFWS) for such a federal action when it may affect listed species.

Field surveys in the project area were conducted specifically for this project between July 13 and 28, 2011. The project area for this analysis is defined as the immediate area in which new projects are proposed within Beaver Creek's SUP area—primarily the Red Tail Camp area, and the Birds of Prey and Grouse Mountain lift/trail pods. However, in some cases, the analysis area for wildlife resources extends beyond project area, based on individual species. For example, the analysis area for Canada lynx encompasses multiple Lynx Analysis Units—which are hundreds of thousands of acres in size, as well as designated lynx linkages that cross federal and regional highways.

AFFECTED ENVIRONMENT

Threatened and Endangered Animal Species

Federally listed and proposed plant and animal species that were initially considered in BA included those identified by the USFWS as potentially present on the WRNF, potentially present on the Holy Cross Ranger District, and/or potentially affected by management decisions associated within the project area (Table 5-1). Uncompahgre fritillary butterfly (*Boloria acrocneuma*), humpback chub (*G. cypha*), bonytail (*Gila elegans*), Colorado pikeminnow (*Ptychocheilus lucius*), razorback sucker (*Xyrauchen texanus*), greenback cutthroat trout (*Oncorhynchus clarkii stomias*), and Canada lynx (*Lynx canadensis*) were identified. Of these species, only Canada lynx has potential to be affected by proposed projects at Beaver Creek. Therefore, Canada lynx is discussed in detail, below.

Canada Lynx

Canada lynx in the contiguous United States was listed as threatened effective April 24, 2000.⁹⁴ With the exception of the Southern Rocky Mountain Region, lynx regions in the United States are geographically connected to the much larger lynx population in Canada. On November 9, 2006, the USFWS published a final rule designating critical habitat for lynx.⁹⁵ No habitats within Colorado were designated critical habitat for lynx.

In an attempt to reestablish a viable population, the CDOW released 218 lynx in the San Juan Mountains.⁹⁶ Based on initial results of the Vail Pass Winter Recreation Study, resident lynx are present in Eagle and Summit Counties.⁹⁷

With respect to developed recreation effects on lynx (relevant to the Proposed Action), Ruediger et al. indicated “to date, most investigations of lynx have not shown human presence to influence how lynx use the landscape. Intuitively we assume that some threshold exists where human disturbance becomes so intense that it precludes use of an area by lynx.”⁹⁸ While lynx and ski areas may not be incompatible, the developed ski terrain itself is a small part of their normally used areas. Larger surrounding tracts of undeveloped, effective forest facilitate lynx use of ski areas.⁹⁹

Habitat connectivity across the project area is addressed both from the perspective of transient lynx (i.e., presumably less familiar with landscape features and exhibiting a broader selection of habitat types during dispersing and male mating season movements than resident lynx) and resident lynx (i.e., those within annual home ranges and exhibiting more restricted foraging movements within the winter home range subset). The ability of lynx to cross the Beaver Creek SUP area is an issue on an east-west and west-east basis, as animals move across the northern end of the Sawatch Range between the two large, largely intact habitat blocks on each side of the ski area, which extend south into the Holy Cross Wilderness. In this area, lynx are most likely to move through the spruce-fir, mixed conifer, and lodgepole pine zones.

Beaver Creek’s SUP area statistics indicate that a majority (roughly 72.1 percent) is “non-habitat” (ski trails, 47.6 percent) and currently unsuitable habitat (24.5 percent). All lynx habitat (winter foraging habitat (WFH) + denning + “other” + currently unsuitable) composes 51.8 percent of the SUP area. Higher quality (“primary”) lynx habitat (WFH + denning), concentrated at upper elevations, comprises a relatively small (22.4 percent) portion of the SUP area.

⁹⁴ USFWS, 2000

⁹⁵ USFWS, 2006

⁹⁶ CDOW, 2006b

⁹⁷ Squires and Roberts, 2009; Thompson, 2011

⁹⁸ Ruediger et al., 2000

⁹⁹ Thompson and Halfpenny, 1989

Lynx diurnal security habitat (DSH) includes those areas that provide cover values that are also relatively isolated from, and unaffected by, human developments and activities. These are areas where largely nocturnal and crepuscular lynx can rest during the day without being regularly displaced or harassed by humans or exposed to other risk factors.¹⁰⁰ Diurnal security habitat is a focal issue at ski areas because it likely affects habitat connectivity across developed and active ski terrain. The closer that effective security habitat is to active ski terrain, the closer to that terrain that a lynx could bed during the day, then cross the ski area from dusk through dawn to the next DSH block on the opposite side of active ski terrain before the ski area reopens the following morning. Distances across developed Beaver Creek terrain are well within a lynx's daily travel distance (DTD) that would allow lynx to completely avoid human interaction. Within the project area it is unlikely that any of the larger intertrail tree islands are effective as DSH during the ski season because of the level of tree skiing. Otherwise, effective DSH is extensive outside of the ski area associated with continuous spruce-fir stands extending down both flanks of the Sawatch Range in the Holy Cross Wilderness.

High-speed, high-volume highways can result in lynx road-kills, fragment and restrict lynx habitat use, impair home range effectiveness, and inhibit local and dispersing movements that may lead to reduced habitat connectivity and the decline of some wildlife populations and species over time due to genetic isolation.¹⁰¹ Traffic analyses (see the Environmental Consequences section, below) assess environmental baseline traffic and projected traffic effects from the Proposed Action on lynx highway mortality and habitat permeability. Pertinent environmental baseline traffic are based on Year 2010 traffic volumes from the Colorado Department of Transportation (CDOT) website and represent the most current available data.

The Beaver Creek project area is located within the Eagle Valley Lynx Analysis Unit (LAU, WRNF LAU #20), defined and assigned by the Forest Service. The Eagle Valley LAU's ability to support a lynx home range is somewhat impaired, with 41.2 percent of its habitat currently unsuitable. The Eagle Valley LAU encompasses 117,235 acres west of Vail Pass, including the south side of the Gore Range and the Eagles Nest Wilderness on the north, the Gore Creek Valley south of I-70, and the Beaver Creek drainage, which juts south into the Holy Cross Wilderness. The Eagle Valley LAU is bisected by I-70 and contains all or portions of the Vail Pass, Dowds Junction, and Castle Peak lynx linkages.¹⁰²

For the purposes of this document, the lynx analysis area includes the Eagle Valley LAU, containing the project area, the contiguous Holy Cross and Brush Creek LAUs, and the regional highway corridors extending through designated lynx linkages. This area is sufficiently inclusive to capture the most far-reaching potential direct, indirect, and reasonably certain effects associated with proposed projects.

¹⁰⁰ Ruediger et al., 2000; Shenk, 2005

¹⁰¹ Forman and Alexander, 1998; Apps, 2000; USFWS, 2000a; Alexander, 1998; Alexander et al., 2004, 2005; Clevenger et al., 2002; Forman et al., 2003

¹⁰² USDA Forest Service, 2008e

R2 Sensitive Insects

One species of R2 sensitive insect is potentially present on the WRNF—the Great Basin silverspot (*Speyeria nokomis nokomis*). However, this butterfly does not have potential habitat within the project area, nor does it have known distributions overlapping the WRNF.

Region Two Sensitive Animal Species

From the current R2 list, a subset of sensitive species—including 1 insect, 5 fish, 2 amphibians, 18 birds, and 8 mammals—was determined to be present or potentially present on the WRNF.¹⁰³ From this subset of the R2 list, the following species are present, or potentially present, in the project area.

Colorado River Cutthroat Trout

Colorado River cutthroat trout (CRCT, *Oncorhynchus clarkii pleuriticus*) are adapted to clear, cold, well-oxygenated streams and lakes, which are devoid of introduced trout. The CRCT analysis area for this project includes potential habitat extending through the project area, to and including Beaver Creek. The various stream reaches draining the project area represent historic, occupied, and potential CRCT habitat.

Beaver Creek is inhabited by brown trout (*Salmo trutta*), cutthroat trout (*O. clarkii*), brook trout (*Salvelinus fontinalis*), and rainbow trout (*Oncorhynchus mykiss*) and is considered an important nursery stream for the Eagle River. The genetically degraded CRCT population in the Beaver Creek drainage is not identified as a recovery population in the Colorado River Cutthroat Recovery Plan. With the exception of Beaver Creek itself, there are no Beaver Creek tributaries known to be occupied by CRCT in or downstream of the project area that would be influenced activities within the project area or that represent potential reintroduction sites.¹⁰⁴ This includes mountain streams on NFS lands that receive fall compensatory releases for snowmaking operations at Beaver Creek.

In 2010 and 2011, the Forest Service sampled fish populations in Beaver Creek, above and within stream reaches that could be affected by activities in the project area for genetic testing by the CDOW. All eight cutthroats tested were hybrids and it is assumed that Beaver Creek does not contain genetically pure CRCT (or greenback cutthroat) based on the stocking history, genetic results, potential for hybridization, and the lack of a barriers between the Eagle River.¹⁰⁵

Boreal Western Toad

The boreal western toad inhabits marshes, wet meadows, and the margins of streams, beaver ponds, lakes, and glacial kettle ponds between 7,000 and 11,860 feet in Colorado.¹⁰⁶ The boreal toad analysis area for

¹⁰³ USDA Forest Service, 2009b. The complete list of R2 species considered is contained in the BE, available in the project file.

¹⁰⁴ Thompson, 2011; habitat assessments during 2011 field surveys

¹⁰⁵ Thompson, 2011

¹⁰⁶ Hammerson, 1999

this project includes all proposed disturbance areas (terrestrial habitat), stream reaches, and riparian habitat (dispersal corridors) that could be affected by proposed activities, to and including Beaver Creek. From these potential impact areas the analysis area extends outward approximately 1.5 miles.

No documented perennial wetland or lacustrine habitat that could provide suitable breeding habitat exists within 1.5 miles of the project area. In addition, there have not been any reports of boreal toad sightings in the Beaver Creek drainage to USFS or CDOW personnel.¹⁰⁷ While there are four known, extant boreal toad breeding sites in the vicinity of the project area, all are geographically isolated and well beyond the maximum known dispersal distances where individuals from those populations could disperse to habitats that would be impacted in the project area.

Northern Leopard Frog

The northern leopard frog analysis area for this project is the Beaver Creek drainage. Northern leopard frogs are widespread across North America, inhabiting the banks and shallow portions of marshes, ponds, lakes, reservoirs, beaver ponds, streams and other bodies of permanent water, especially those having rooted aquatic vegetation.¹⁰⁸

There are no recent records of this frog's presence in the vicinity of Beaver Creek. Leopard frogs have only been collected on the Rifle and Blanco Districts of the WRNF, far from the project area.¹⁰⁹ Field surveys conducted through proposed Beaver Creek disturbance areas did not detect leopard frogs or potential breeding habitat.

Northern Goshawk

Goshawks (*Accipiter gentilis*) are a forest-interior species generally associated with mature aspen and conifer forests between 7,500 and 11,300 feet on the WRNF.¹¹⁰ Goshawks nest in mature to old-growth aspen and mixed aspen and coniferous forests on gently sloping north or east aspects near the bottom of stream courses.¹¹¹ Goshawks exhibit high breeding-territory fidelity and nests may be reused in subsequent years.

The Forest Service monitors known goshawk nest sites on the Holy Cross Ranger District. Natural Diversity Information Source (NDIS) data indicate that goshawks are uncommon in Eagle County and that one-to-two individuals can be observed daily in appropriate seasons and habitats. The goshawk analysis area for this project extends outward from proposed disturbance areas to the furthest extent of any goshawk home range that could overlap the disturbance areas. Because goshawk home ranges can be

¹⁰⁷ Ibid.

¹⁰⁸ Stebbins, 1966; Hammerson, 1999

¹⁰⁹ Thompson, 2011

¹¹⁰ Doerr, 2004

¹¹¹ Shuster, 1980; Andrews and Richter, 1992

in the range of 3,200 to 6,800 acres, the goshawk analysis area extends 4-to-6 miles beyond the project area and includes the northern end of the Swatch Range.¹¹²

Goshawk surveys were conducted in forest stands containing proposed disturbance areas that were large enough (i.e., \geq approx. 30 acres) and structurally suitable to support a potential goshawk nest site. No evidence of goshawks was detected within the project area during the calling surveys or during other wildlife-oriented fieldwork associated with the project or past projects overlapping Beaver Creek.¹¹³ It is unlikely that goshawks nest within the developed interior of the Beaver Creek SUP area because of the fragmentation across the ski area reducing most intertrail islands below the minimum approximately 30-acre nest block patch size, the natural high elevation forest stand characteristics, and the superior nesting and foraging habitat at lower elevations in the surrounding area. About one-half of the project area is composed of spruce-fir forest and it is uncommon for goshawks to nest in that habitat in Colorado.¹¹⁴ Most forest stands in the project area, including lodgepole stands that goshawks are known to nest in on the Holy Cross Ranger District, do not have open understories, which would make it difficult for goshawks to hunt below the canopy, however, that does not mean that goshawks could not hunt the area. Indeed, goshawks have been detected occasionally hunting developed portions of Vail, Ski Cooper, Breckenridge and Powderhorn ski areas, presumably as part of an overlapping nest territory.¹¹⁵ Therefore, it is possible that goshawks could utilize portions of the Beaver Creek project area and forage on the primary prey species (snowshoe hares, red squirrels, and blue grouse) that are present in some intertrail islands. Therefore, habitats within the Beaver Creek project area represent potential foraging habitat and it is possible that goshawks could utilize portions of the area as part of a local pair's large foraging range.

Northern Harrier

Northern harriers (*Circus cyaneus*) are relatively rare breeders that nest in a variety of habitats, including native and non-native grasslands, agricultural lands, emergent wetlands, and tall desert shrublands, with the only requirement being abundant cover, such as that provided by tall reeds, cattails, and grasses.¹¹⁶ They have been documented in Eagle County as a possible, but unconfirmed, breeder. Their primary breeding areas in Colorado include extensive wetlands on the eastern plains and the San Luis Valley.¹¹⁷ In the vicinity of the project area (and higher mountains), harriers are considered rare to locally uncommon.¹¹⁸ During late summer and fall migration, harriers may wander or range (i.e., considered

¹¹² Towry, 1984; Hoover and Wills, 1984

¹¹³ Thompson, 2011

¹¹⁴ Rhea et al., 2006

¹¹⁵ Thompson, 1994a, unpubl. 1991 data, 2001a

¹¹⁶ Andrews and Richter, 1992; Kingery et al., 1998

¹¹⁷ Id.

¹¹⁸ Andrews and Richter, 1992

accidental and rare—one record in the state) above treeline.¹¹⁹ Territory sizes are 1-to-1.5 square miles, although they may be linear and up to 1 mile long.

The northern harrier analysis area for this project is Beaver Creek's SUP area, which would include the local transitory range of any migrants that might move through the project area. This species has not been detected within Beaver Creek's SUP area during recent and former wildlife surveys.¹²⁰ The project area and surrounding habitat within Beaver Creek's SUP area are unsuitable as breeding habitat. It is possible, though extremely unlikely, that during late summer and fall migration, harriers could wander through the SUP area and opportunistically hunt non-forested habitats, including ski trails.

American Peregrine Falcon

Peregrine falcons (*Falco peregrinus anatum*) generally occur on the Forest as rare breeders and, more often, as uncommon, non-nesting migrants. Viable peregrine nesting sites possess two components: (1) adequate nesting habitat, and (2) extensive hunting habitat with an adequate prey base to support the adults and their offspring.¹²¹ Nesting sites are located on precipitous cliffs ranging in height from 40 to 2,100 feet, averaging 200 to 400 feet tall. Several ledges, potholes, or small caves must be present in the cliff face to function as a suitable nest site. A breeding pair will frequently alternate their nesting activities to different ledges on a cliff face between years, and they will often relocate to adjacent cliff faces. As a result, protective measures must address an entire cliff complex rather than an individual cliff.

An active peregrine falcon eyrie is considered to be present in the upper Eagle River watershed and the project area is considered to be within an active hunting territory. From 1997 to 2005, a nesting pair occupied three to four different nest sites in the nest complex.¹²² No peregrine nesting was detected on these cliffs in 2006 or 2007, although a pair of birds that included a subadult female was present in the vicinity during both of those years. No monitoring has been conducted since 2007. Birds from this eyrie are thought to prey on birds along the river, but probably extend foraging into adjacent uplands.

The peregrine falcon analysis area for this project extends approximately 30 miles from the eyrie, the maximum hunting distance away from the nest site that would also overlap the project area. The project area is located within 10 miles, but beyond 1 mile of the active peregrine eyrie. There are no habitats within the project area that support above average prey densities or that concentrate prey and expose the moderate prey base to peregrine attack any more so than other habitats common in the surrounding area.

Boreal Owl

Boreal owls (*Aegolius funereus*) inhabit mature and late-successional spruce-fir and spruce-fir/ lodgepole pine forests interspersed with small meadows, streams, and wetlands. Recent surveys in Colorado have

¹¹⁹ Andrews and Righter, 1992; Bailey and Niedrach, 1965; Kingery et al., 1998

¹²⁰ Thompson, 2011

¹²¹ Craig, 1978; Craig and Enderson, 2004

¹²² Thompson, 2011

shown that the species is widely distributed in suitable habitats, with records from most of the higher mountain ranges in the state.¹²³ Boreal owls are tolerant of human and machine noise.¹²⁴ In Colorado, these owls have nested within 30 meters of a major highway.¹²⁵ There is no evidence that human disturbance is an important factor in boreal owl nest loss or movements and the species is not considered to be in any immediate peril.¹²⁶

The boreal owl analysis area for this project extends outward from the boundaries of the project area to the furthest extent of any boreal owl home range that could overlap the disturbance areas. Because boreal owl home ranges can be in the range of 3,447 to 3,894 acres, the boreal owl analysis area could extend 3-to-4 miles beyond the project area. No boreal owl calling surveys were conducted in the project area because it is associated with relatively small intertrail islands within the developed interior of the ski area where nesting is less likely because of habitat fragmentation. However, two intertrail islands (the 3.5-acre spruce-fir stand between *Goshawk* and *Peregrine* above West Fall Road and the 9.3-acre lodgepole and mixed conifer stand above and below West Fall Road between *Peregrine* and *Golden Eagle*) are structurally suitable as boreal owl nesting habitat. Most other spruce-fir and mixed conifer habitat along smaller intertrail island edges within the project area could also provide foraging values for one or more pairs of owls.

American Three-Toed Woodpecker

Three-toed woodpeckers (*Picoides tridactylus*) are most common in years and areas where trees have high insect populations due to disease or fire.¹²⁷ Elsewhere, they occur at low densities, even in old-growth stands. This primary cavity nester is generally associated with spruce-fir forests, but they may also occur in ponderosa pine, Douglas-fir, and lodgepole pine forests supporting high insect populations. Suitable three-toed woodpecker habitat for the present analysis is characterized as mature spruce-fir. It is speculated that fire suppression has led to forest conditions favorable to wood-boring insect infestations that this species feeds on.¹²⁸ This suggests that the Colorado population is near historic high densities in unburned forests, but does not support an abundance of high-density populations that occur after fires. It is unclear how three-toed woodpeckers respond to MPB epidemics in terms of moderate term population fluctuations.

The three-toed woodpecker analysis area extends outward from the boundaries of the project area to the furthest extent of any three-toed woodpecker home range. Therefore, the three-toed woodpecker analysis area could extend approximately 1 mile beyond the project area. Three-toed woodpeckers were not

¹²³ Webb, 1982; Palmer, 1984; Ryder et al., 1987; Stahlecker and Rawinski, 1990; Ryder, 1991, 1994; Thompson, 1994a

¹²⁴ Hayward and Verner, 1994

¹²⁵ Ryder as cited in Hayward and Verner, 1994

¹²⁶ Hayward and Verner, 1994

¹²⁷ Koplín, 1969; Crockett and Hansley, 1978

¹²⁸ Kingery et al., 1998

detected in the project area during 2011 surveys, but individuals have been detected within the fragmented interior of the ski area during prior surveys, and potential nesting and foraging habitat is present within project component areas.¹²⁹ Three-toed woodpeckers have also been detected using (including nesting in) suitably mature and senescent spruce-fir and lodgepole forests on developed portions of Breckenridge, Vail, Monarch, Copper Mountain, Durango Mountain Resort, Wolf Creek, and Eldora ski areas.¹³⁰ Based on habitat distribution and structural conditions present, most conifer stands in the project area represent potential nesting and foraging habitat.

Olive-Sided Flycatcher

In Colorado, Olive-sided flycatchers (*Contopus cooperi*) breed from 7,000 to 11,000 feet, primarily in dense, mature spruce-fir and Douglas-fir forests, especially on steep slopes or near cliffs, and less often in other coniferous forests, montane and foothill riparian forests, and aspen forests.¹³¹ For this analysis, suitable habitat is defined as spruce-fir and mixed conifer. Olive-sided flycatchers use suitably mature and senescent spruce-fir forests on developed portions of other ski areas.¹³² While habitat fragmentation may affect this species, on ski areas it does not exclude them. Indeed, the openings created by ski trails may enhance flycatcher breeding habitat in some contexts.¹³³

The olive-sided flycatcher analysis area for this project extends outward to the furthest extent of any home range that could overlap the project area. Olive-sided flycatchers were not detected in the project area during 2011 surveys, but individuals have been detected within the fragmented interior of the ski area during prior surveys, and potential nesting and foraging habitat is present within project component areas.¹³⁴ Based on habitat distribution and structural conditions present, some conifer stands (i.e., those larger intertrail islands that have standing dead trees, also known as snags, extending through the forest canopy) in the project area represent potential nesting and foraging habitat. Heavily fragmented forest, the interior of large intertrail islands and closed forest blocks, and islands without prominent snags do not appear to be occupied. Olive-sided flycatcher habitat values in the existing SUP area should improve with ski trail succession, as trails succeed towards native meadows supporting higher density insect populations and as existing spruce-fir stands develop higher snag densities.

Pygmy Shrew

Pygmy shrews (*Microsorex hoyi montanus*) are associated with the northern boreal forests of Canada and the northern United States. In Colorado, the three locations where this shrew has been captured represent a variety of habitats including spruce-fir and lodgepole pine forests, clearcuts and selectively logged forests, forest-meadow edges, boggy meadows, willow thickets, aspen-fir forests, and subalpine

¹²⁹ Thompson, 2011

¹³⁰ Thompson 1994a, 2003b, 2005, 2011, 1994-2011 unpubl. data

¹³¹ Andrews and Righter, 1992

¹³² Thompson 1994a, 2005, 2011, 1994-2008 unpubl. data

¹³³ Kingery et al., 1998

¹³⁴ Thompson, 2011

parkland.¹³⁵ However, they are thought to occur primarily in spruce-fir and lodgepole pine forests, where they are most abundant in mature and old-growth structural stages.¹³⁶

The pygmy shrew analysis area for this project extends outward to the furthest extent of any home range that could overlap the project area. Because pygmy shrew home ranges can be in the range of several acres, the pygmy shrew analysis area could extend several hundred yards beyond the proposed disturbance areas.¹³⁷

No suitable trapping surveys have been conducted within the project area to detect this rare species. Until 2009, pygmy shrews had not been detected in Eagle County or anywhere else on the WRNF.¹³⁸ Nevertheless, this species remains rare on the landscape. Based on the species' broad habitat affinities, forested and mesic (relatively wet) habitats within the project area fall within the broad habitat continuum known to be occupied by this species.

American Marten

Martens (*Martes americana*) are boreal weasels closely associated with dense, late-successional, spruce-fir forests in Colorado, although their seasonal distribution also extends upward into the alpine and down into lodgepole pine forests and coniferous riparian corridors.¹³⁹ Based on body size, marten population density is naturally low and relatively large territories are required to meet their prey demands.¹⁴⁰ Home range size varies widely among reported studies, due to sex, geographic area, prey abundance, and habitat characteristics, including type and degree of forest fragmentation. Even in optimal habitat, total population size is limited by the biological tolerance limits of the species for a given landscape.

Martens are well distributed across the WRNF in suitable habitats in mid- to upper elevation zones. Although they are most commonly observed in spruce-fir forests, they are occasionally seen in lower-elevation, mixed-conifer forests. Marten are present in the SUP area, most common in spruce-fir and upper elevation mixed conifer stands, but also occasionally extending into the lodgepole pine zone, where spruce-fir and mixed conifer habitats extend down along creek corridors.

The American marten analysis area extends outward from the project area to the furthest extent of any marten home range that could overlap the disturbance areas. Because marten home ranges can be in the range of a square mile, the marten analysis area could extend to an approximately 6-square mile area overlapping the project area.¹⁴¹ Furthermore, marten are susceptible to even moderate-speed road

¹³⁵ DeMott and Lindsey, 1975; Fitzgerald et al., 1994

¹³⁶ Towry, 1984

¹³⁷ Fitzgerald et al., 1994

¹³⁸ Siemers, 2009; Hugie et al., 1996; Thompson, 1996a,b, 1997, unpubl. data; Wilson and Ask, 1999; Wilson and Hadley, 2000a,b; Hadley and Wilson, 2002; USDA Forest Service, 2002h

¹³⁹ Armstrong, 1972; Towry, 1984; Fitzgerald et al., 1994; Buskirk and Ruggiero, 1994; Banci, 1994

¹⁴⁰ Buskirk and Ruggiero, 1994

¹⁴¹ Clark et al., 1989; Clark and Campbell, 1977

mortality. Therefore, the marten analysis area extends to the highway corridors servicing Beaver Creek, to address those potential indirect effects.

Martens were not detected in the project area during 2011 surveys, but individuals have been detected within the fragmented interior of the ski area during prior surveys, and potential foraging and denning habitat is present within some forested project component areas.¹⁴² Marten are more common across Beaver Creek in upper elevation spruce-fir stands and those along major drainage bottoms (e.g., Beaver Creek), but they also occur in lower elevation forests, including lodgepole pine, Douglas-fir, and pine/aspen ecotones. Habitats within Beaver Creek are structurally capable of supporting all life history functions of martens, including denning, and could contain or overlap the ranges of at least several males and a greater number of overlapping female home ranges. Marten occur within the developed interior of the ski area, but the fragmented habitat is less effective and probably requires increased home range size. Extensive, effective marten habitat exists to the southeast and southwest of the ski area along the east and west slopes of the Sawatch Range. Dispersed recreational use in the surrounding landscape probably has little direct or indirect impact on marten habitat effectiveness.

North American Wolverine

Wolverines (*Gulo gulo luscus*) are solitary, wide-ranging and exist in low densities in large roadless or isolated areas. Recent CDOW surveys found scant evidence of wolverine presence in Colorado and concluded that if any remain, their numbers are too small to represent a viable population.¹⁴³ Based on the large home range size of wolverines and low numbers in Colorado, wolverine use of the project area, if it occurs, would be incidental and transitory.

Wolverines are a circumpolar species, which historically reached their southern, North American distributional limits in Colorado.¹⁴⁴ They are scarce in other parts of the south-central Rocky Mountains and were, apparently, never common in Colorado (at best, wolverines were apparently uncommon in Colorado's mountains even before the arrival of Europeans and, if present, they are undoubtedly less common today).¹⁴⁵ Wolverines occur at low densities throughout their distribution. Animals may travel over 20 miles per day and range over large territories. Male territories are as large as 772 square miles, while those of females may be 150 to 190 square miles.¹⁴⁶ The CDOW initiated a wolverine project in 1978 to summarize wolverine history in Colorado and to accumulate information about their current status.¹⁴⁷ Although the study provided circumstantial evidence that wolverine were present in Colorado, it did not identify the presence of viable populations.¹⁴⁸ Based on approximately 9,100 km of winter

¹⁴² Thompson, 2011

¹⁴³ CDOW, 2010

¹⁴⁴ Wilson, 1982

¹⁴⁵ Deems and Pursley, 1978; Hall, 1981; Wilson, 1982; Nead et al., 1985; Lechleitner, 1969; Armstrong, 1972

¹⁴⁶ Krott, 1960; Halfpenny, 1981; Nead et al., 1985

¹⁴⁷ Nead et al., 1985

¹⁴⁸ Halfpenny, 1981; Nead et al., 1985

tracking surveys conducted by Thompson in Colorado between 1986 and 2011, no evidence of wolverine has been detected.¹⁴⁹

Although the Beaver Creek project area is located within the wolverine's historic range, only two, positive identifications of a wild wolverine (one killed on the Colorado/ Utah border in 1979 and the other, a radio-collared male from Montana that traveled to Rocky Mountain National Park in June, 2009 and into central Colorado in 2010) have been documented in Colorado in the last 30 years.¹⁵⁰ The CDOW has been unable to verify that a viable population persists and current assessments now consider Colorado to be outside of the extant wolverine distribution.¹⁵¹

The wolverine analysis area for this project extends outward from the project area to the extent of transitory wolverine movements that could overlap the disturbance areas. There are no wolverine home ranges in Colorado, currently or likely into the future. So the analysis area accounts for the dispersing movements of the single transient male. Habitat use of that animal is likely confined to remote alpine areas and big game winter ranges, except where it might cross highways that are purposefully avoided by this species.¹⁵² Nevertheless, wolverines are susceptible to highway road mortality. Most wolverine highway crossings would likely occur in the designated lynx linkages. Therefore, the wolverine analysis area will also extend to the highway corridors servicing Beaver Creek, to address those potential indirect effects.

Management Indicator Species

From the current list of Forest-wide MIS, three—elk (*Cervus elaphus*), aquatic macroinvertebrates, and all trout—were identified as requiring analysis for this project. This is based on Forest Plan selection criteria and the presence or potential occurrence of these organisms and their habitats on NFS lands within or adjacent to the project area.¹⁵³ These project MIS are discussed below. Other MIS were not selected as project MIS because they do not occur on NFS lands in the project area and they and their associated habitats on NFS lands would not be affected by the Proposed Action. MIS not selected as project MIS include cave bats (no caves present or affected), American pipit (*Anthus rubescens*; no alpine grassland present), Brewer's sparrow (*Spizella brewerii*, no sagebrush present or affected), and Virginia's warbler (*Vermivora virginiae*, no mountain shrubland habitat present or affected).

¹⁴⁹ Thompson, 2011

¹⁵⁰ Bissell, 1978; Byrne, 1998; Pankratz, 2009; Aubry et al., 2007 indicated that the most recent viable record of a wolverine in Colorado was from 1919

¹⁵¹ Halfpenny, 1981; Kenvin, 1992, 1993, 1994, 1995; Byrne and Copeland, 1997; Byrne, 1998; Aubry et al., 2007 with the exception of the dispersing Montana male

¹⁵² Thompson, 2011

¹⁵³ USDA Forest Service, 2006b, 2002d,e, 2005f

American Elk

Rocky Mountain elk inhabit the central and northern Rocky Mountains, including western Canada, south through eastern Oregon and Washington, Idaho, western Montana, Wyoming, Colorado, Utah, Nevada, New Mexico and Arizona. Colorado supports the largest elk population of any state or province where they range over much of the western two-thirds of the state. Elk range over most of the WRNF and use essentially all habitats.

Elk were selected as a MIS to answer the Forest-level question: “Does Forest motorized and non-motorized travel and recreation management result in effective use of habitat by ungulates?”¹⁵⁴ Elk were selected as a project-level MIS for the Beaver Creek project because they are seasonally present. This species was *not* chosen as a MIS because of any viability concerns—there is not a viability concern for this species on the WRNF, and viability is not expected to become a concern through implementation of proposed projects at Beaver Creek or continued implementation of the Forest Plan. Therefore, viability of elk will not be addressed further in this document.¹⁵⁵

The elk analysis areas considered herein includes the project component areas, the furthest home ranges of elk seasonally overlapping the project area (generally Eagle County), and the WRNF.

Aquatic Macroinvertebrates

Aquatic macroinvertebrates are those invertebrates that spend at least part of their life cycle in water.¹⁵⁶ These include worms, mollusks, mites, and insects. Insects are by far the most common. Aquatic macroinvertebrate communities are influenced by the timing of flows and water quality in the streams in which they live. Geology, elevation, temperature, gradient, and substrate distribution are other factors that commonly influence macroinvertebrate communities. Although sensitive species occur in most insect orders, three orders are comprised primarily of species that are more sensitive to disturbance. These are Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), collectively “EPT.” Additionally, a specific WRNF metric was developed identifying local EPT taxa sensitive to sediment.

On the WRNF, aquatic macroinvertebrates were selected to address the trend and condition of flowing waters only. Because of their wide distribution and their sensitivity to disturbance and pollutants, aquatic macroinvertebrates are widely used to monitor the health of streams and rivers. This group was not chosen as a MIS because of any viability concerns, there is not a viability concern for this species on the WRNF, and viability is not expected to become a concern through implementation of this project or continued implementation of the Forest Plan.

¹⁵⁴ USDA Forest Service, 2002e

¹⁵⁵ USDA Forest Service, 2002e,f

¹⁵⁶ USDA Forest Service, 2004a

The aquatic macroinvertebrate analysis areas for this project includes those streams on NFS lands (on-site and off-site) draining the project area and associated with snowmaking-related water diversions and augmentation that could be affected by sediments and increased flows from the implementation of proposed projects.

All Trout (brook, brown, rainbow, & Colorado River cutthroat)

All trout, including brook (*Salvelinus fontinalis*), brown (*Salmo trutta*), rainbow (*Oncorhynchus mykiss*), Colorado River cutthroat (*O. clarkii pleuriticus*), and their hybrids (hereinafter MIS trout, or trout), occur in most of the perennial water bodies on the WRNF, including streams, rivers, lakes, and reservoirs. Trout may be excluded from some areas due to chemical contamination below mines or by natural or human-caused barriers. At high elevations, trout may be absent due to water temperature. On the Forest, trend and condition are considered in streams and rivers only. Therefore, trout in still water habitats will not be discussed further in this document.

The timing of flows, water quality, and availability of various habitat features such as deep pools, cover, and spawning gravels influence trout abundance. Geology, elevation, temperature, gradient, and substrate distribution are other factors that commonly influence trout abundance. As habitats are degraded, either by chemical pollutants, increased sediment, or unfavorable changes in flow (especially severe reductions), trout typically respond with lower abundance and uneven year class distribution.

Fish communities are used to describe the existing condition of the project area and potential effects of various project components. Total trout density, or the number of all trout individuals per 100 meters of stream, is an MIS, and a useful measure of habitat quality.

This group was not chosen as a MIS because of any viability concerns—there is not a viability concern for this MIS group on the WRNF, and viability for this MIS group is not expected to become a concern through implementation of proposed projects or continued implementation of the Forest Plan.

The all trout analysis areas for this project includes those Beaver Creek drainage streams on NFS lands draining the project area and those affected by water diversions and augmentation where aquatic habitats could be affected by the Proposed Action.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

The No Action Alternative is a true no action alternative and reflects a continuation of existing operations and management practices at Beaver Creek without major changes, additions, or upgrades on NFS lands. Alternative 1 would have no direct or indirect impacts on any federally listed, R2 sensitive or rare, or MIS animal species.

Alternative 2 – Proposed Action

Threatened and Endangered Species

Uncompahgre Fritillary Butterfly

The project area is approximately 80 miles outside (north) of the Uncompahgre fritillary butterfly's limited range. While this butterfly may also occur in parts, or in other parts, of the Rio Grande, San Juan, Uncompahgre, Gunnison, San Isabel, and White River National Forests, alpine areas north of Continental Divide from Independence Pass to Hoosier Pass do not support potential habitat for this species based upon intensive surveys by qualified butterfly experts. No proposed Beaver Creek Mountain Improvements project disturbance areas extend above 11,399 feet or into the alpine and snow willow stands and their associated plant communities are not present. Therefore, potential habitat for this butterfly is not present and the Proposed Action would have “**no effect**” on this species.

Big River Fish

With the implementation of Alternative 2, there would be an average annual use of 728.6 acre feet (AF) of water at Beaver Creek for snowmaking, leaving 581.0 AF of unused depletions that were authorized in prior Section 7 consultations.

Prior consultations under Section 7 of the Endangered Species Act (ESA) adequately cover Beaver Creek's existing and planned snowmaking diversions. The biological opinions associated with the prior consultations at Vail Mountain and Beaver Creek anticipated snowmaking diversions averaging 1,912.6 AF annually. Of this amount, 1,309.6 AF of water could originate from snowmaking at Beaver Creek. The proposed additional 35.3 AF of water depletions downstream in the Colorado River warrants a “**may affect, likely to adversely affect**” determination. However, (1) because this effect has already been accounted for in authorized depletions associated with previous consultations, (2) because total water diversions and depletions associated with Alternative 2 would not result in any additional effects above those previously authorized through Section 7 consultations, and (3) because previous consultations directed compensatory reservoir releases to minimize depletion effects that are within Vail Associates' augmentation storage limits, no additional consultation on the four big river fish is requested on this depletion and Big River Fish (humpback chub, Colorado pikeminnow, razorback sucker and bonytail) were dropped from further consideration in the BA.

Greenback Cutthroat Trout

With the exception of Beaver Creek, there are no Beaver Creek tributaries known to be occupied by greenback cutthroats in or downstream of the project area that would be influenced by the Proposed Action (CDOW WRIS Maps, Sep. 1997, no fish data for Beaver Creek drainage on NDIS website accessed Sep. 6, 2011, habitat assessments during 2011 field surveys, and M. Grove, USFS, pers. comm., Sep 20, 2011) or that represent potential reintroduction sites. Therefore, the Beaver Creek Mountain Improvements project would have “**no effect**” on this species.

Canada Lynx

Alternative 2 impacts to lynx habitat are largely those associated with the development of conventional ski trail segments into what would become the woman's downhill course. Alternative 2 would permanently convert 19.3 acres of lynx habitat (10.1 acres of WFH and 9.2 of "other" habitat) into non-habitat as a result of cutting trails through intertrail islands within Beaver Creek's developed interior of (Table 3F-1). Additional temporary disturbance would affect approximately 33 acres of existing ski trails and roads (all "non-habitat"). The 19.3 acres of lynx habitat represents 1 percent of the 1,916.9 acres of total lynx habitat that is present within Beaver Creek's SUP area (refer to Table 3F-2) and 0.04 percent of the 55,064.8 acres of the lynx habitat now present within the Eagle Valley LAU. While snowshoe hares associated with affected intertrail islands could adjust their home ranges to connect the large, remaining, high quality intertrail islands into a functional home range, there could nevertheless be some reduction in the local hare population, potentially impacting Lynx.

Alternative 2 impacts would be additive to the permanent habitat conversion that has occurred to date for ski area development. Alternative 2's incremental impacts would adversely affect a LAU that's ability to support a lynx home range is somewhat impaired (41.2 percent of the Eagle Valley LAU supports currently unsuitable habitat), but not preclude this area at the northern end of the Sawatch Range from supporting at least a portion of a lynx home range.

**Table 3F-1:
Alternative 2 Impacts to Lynx Habitat Types Within the Beaver Creek SUP Area**

Lynx Habitat Type	Alternative 1 Acres (%) Currently Present	Alternative 2 Acres (%)
Winter Foraging	123.7 (3.3)	10.1 (8.2)
Denning	707.6 (19.1)	0.0 (0)
Other	177.8 (4.8)	9.21 (5.2)
Currently Unsuitable	907.8 (24.5)	0.0 (0)
Total Lynx Habitat ^c	1,916.9 (51.8)	19.31 (1.0)
Non-habitat	1,763.7 (47.6)	32.29 (1.8)
Private	22.6 (0.6)	1.67 (7.4)
Total	3,703.2 (100)	52.28 (1.4)

Source: USFS (2002a, update provided by L. Roberts, USFS, May 4, 2011), SE Group, and Western Ecosystems, Inc.

Under Alternative 2, 19.3 acres of lynx habitat and 32.3 acres of "non-habitat" would be affected on NFS lands, with breakdowns shown in Table 3F-2. There would be impacts to approximately 1.7 acres of "non-habitat" on private land. Table 3F-2 shows Alternative 2 changes to lynx habitat and resulting statistics in the Eagle Valley LAU. Virtually all affected lynx habitat would be permanently converted to "non-habitat." The 32.3 acres of "non-habitat" (existing ski trails and roads) that would be disturbed for infrastructure burial would be returned to their former uses and value as "non-habitat."

**Table 3F-2:
Changes to Lynx Habitat in the Eagle Valley LAU**

Habitat Description	Acres Affected by Alternative 2 ^a	Resulting Acres ^b	Net Change in LAU Habitat (%)	Updated Habitat in LAU ^b (acres)	Updated % of Lynx Habitat in LAU
Winter Foraging	10.1	-10.1	-0.11	9,257.8	16.8
Denning	0	0	0	11,460.1	20.8
Other	9.21	-9.21	-0.08	11,646.0	21.2
Currently Unsuitable	0	0	0	22,681.6	41.2
Total Lynx Habitat	19.31	-19.31	-0.04	55,045.5	100
Non-habitat	32.96	+19.31	+0.05	42,601.9	-
<i>USFS Acres</i>	<i>50.61</i>	<i>0</i>	<i>0</i>	<i>97,647.4</i>	<i>83.3</i>
<i>Private Acres</i>	<i>1.67</i>	<i>0</i>	<i>0</i>	<i>19,587.6</i>	<i>16.7</i>
Total Acres	52.28	0	0	117,235.0	100

^a On NFS and private lands.

^b Net with implementation of the Proposed Action.

Source: USFS (2002h, update provided by L. Roberts, USFS, May 4, 2011), SE Group, and Western Ecosystems, Inc.

All proposed disturbances associated with Alternative 2 would occur in active ski terrain within the developed interior of the ski area. None of the intertrail tree islands that would be affected by the Proposed Action are effective as denning habitat or DSH because of ski area disturbances (during the ski season and during spring maintenance, coincident with denning periods), habitat fragmentation, and spatial, maternal, home range considerations. Alternative 2 would not result in increased skier use (i.e., skiing of closed areas, or backcountry skiing) of areas outside of currently skied areas that may be functional as denning habitat or DSH. Thus, Alternative 2 would not affect any currently effective denning habitat or DSH.

Under Alternative 2, lynx travel distances across the ski area through the project area would remain unchanged. Environmental baseline distances that a lynx might take through active ski terrain in the vicinity of the project area would remain well below the maximum range recommended for project planning that allows for habitat connectivity.¹⁵⁷ The two continuously forested bands above the developed ski area that connect undeveloped portions of the east and west slopes of the Sawatch Range in the Holy Cross Wilderness would remain unaffected and would continue to facilitate lynx movements across the northern end of the Sawatch Range that avoid fragmented ski terrain. Habitat connectivity across the ski area and along the northern end of the Sawatch Range will become further impaired with the loss of forest cover associated with the progression of the MPB epidemic in the lodgepole pine and mixed conifer zones. However, Alternative 2 would not further impair habitat connectivity across the ski area.

The two years of construction activities associated with Alternative 2 should not result in lynx injury or mortality, but it could displace a lynx that might be moving through activity areas and access corridors.

¹⁵⁷ Ruediger et al., 2000; USDA Forest Service, 2008e

Although lynx may be active at any time of day, their primary nocturnal and crepuscular (dawn/dusk) activity period is largely exclusive with the daytime construction period. Construction noise would alert any lynx that might be moving through the area, giving it ample opportunity to avoid the construction activities. The likelihood of a healthy lynx being killed by construction traffic off regional highways and roads is discountable because of only partly overlapping activity periods, the low number of lynx present in the landscape, and the slow speeds of vehicles (<20mph) on mountain roads. The potential effects to lynx of the above construction-related activities would meet USFWS and NMFS definitions of “insignificant” and “discountable.”

Anticipated total traffic contributions to regional highway segments crossing through designated lynx linkage areas from all attendees and volunteers associated with the 2015 World Alpine Skiing Championships are shown in Table 3F-3. The data reflects a reasonable range of traffic contributions that might be expected during peak travel days (most likely at the beginning and end of the event), ebb travel days (associated with peak attendance), and mean volumes over the course of the entire event, including pre-and post-event travel days. The 2015 World Alpine Skiing Championships would add a relatively high amount of traffic for a relatively short duration. Traffic for a single event could add between 719 vehicles per day (VPD) to 2,674 VPD to the I-70 corridor and the six lynx linkage areas (LLA) between Herman Gulch and Wolcott (refer to Table 3F-3). Traffic contributions through the Tennessee Pass LLA would be expected to be modest and associated with only those volunteers commuting from Leadville and Buena Vista.

Table 3F-3:
Total Traffic Contributions to Regional Highway Segment(s) Crossing Through
Designated Lynx Linkage Areas^a

Highway, Monitoring Point	Projected 2015 Traffic Volume^b	Total (mean/ max./ min.) WAC Vehicle Contributions (VPD) through the LLA^c	Total (mean/ max./ min.) WAC Vehicle Contributions as a % of Year 2015 AADT through the Respective LLA(s)^c
I-70, Herman Gulch LLA ^b	30,510	719/ 1,110/ 2,674	2.4/ 3.6/ 8.8
I-70, Loveland Pass LLA ^b	32,625	719/ 1,110/ 2,674	2.4/ 3.6/ 8.8
I-70, Officer's Gulch LLA ^b	24,805	719/ 1,110/ 2,674	2.4/ 3.6/ 8.8
I-70, Vail Pass LLA ^b	23,275	719/ 1,110/ 2,674	2.4/ 3.6/ 8.8
I-70, Dowds Jct. LLA ^b	37,200	719/ 1,110/ 2,674	2.4/ 3.6/ 8.8
Hwy. 24, Tennessee Pass LLA ^b	1,994	18	0.9
I-70, Castle Peak LLA ^b	25,575	739/ 837/ 1,228	2.9/ 3.3/ 4.8

^a Total traffic contributions from all attendees and volunteers

^b 2015 is five years from the current environmental baseline. Five year growth factor = CDOT's 20 year growth factor/ 4.

^c Mean, maximum, and minimum traffic contributions based on assumptions in text and prior traffic tables. LLA = Lynx Linkage Area.

Source: CDOT website, Aug. 8, 2011, Vail Resorts Aug. 18, 2011, and Western Ecosystems, Inc.

Traffic contributions associated with the 2015 World Alpine Skiing Championships would be additive to the high traffic volumes through all designated LLAs along I-70 that are currently well above the 2,000 to 5,000 VPD range that have been documented to impair lynx movements and where traffic volumes (>4,000 VPD) pose more serious threats to highway mortality and habitat fragmentation.¹⁵⁸

The potential traffic-related effects of the 2015 World Alpine Skiing Championships would not be insignificant and discountable on lynx. However, while there is the potential for adverse effects (including increased highway mortality, traffic-impaired habitat connectivity and permeability, reduced home range efficacy, and impaired recovery of the Southern Rockies lynx population) to be realized, the likelihood of these effects occurring may be tempered somewhat by the relatively short duration of this one-time event. In addition, as it is scheduled in February, the 2015 World Alpine Skiing Championships would occur at a time of year when lynx are relatively sedentary within higher quality subsets of their home range (September into April) where they are less likely to be making extended movements that might take them across regional highways.¹⁵⁹ Furthermore, crossing the I-70 corridor would present a significant challenge for transient lynx whether Alternative 2 is implemented or not.

Therefore, for the above reasons, Alternative 2 “may affect, [and is] likely to adversely affect” Canada lynx.” Alternative 2 is consistent with all applicable Southern Rockies Lynx Management Direction (SRLMD) standards and guidelines and with Section 7(d) of the ESA.

To minimize traffic contributions directly related to the 2015 World Alpine Skiing Championships, and reduce vehicle trips through the lynx linkage areas, additional measures will be developed in coordination with Beaver Creek to promote strategies to reduce vehicle use. This may include the availability of additional vans or buses owned and operated by Vail Resorts, Inc. By utilizing available resources to promote the use of regional transportation for employees, volunteers, and guests, a tangible reduction in the number of daily vehicle trips and an increase in the average vehicle occupancy (AVO) rate can be achieved. This Traffic Volume Minimization Plan focuses on the utilization of mass transportation, namely the Colorado Mountain Express (CME) shuttle service, as a means of quantifiably reducing the 2015 World Alpine Ski Championship’s traffic contributions to I-70. The result will be reduced, event-related traffic volumes on regional highways that will further reduce potential adverse effects to lynx and other wildlife present during winter in those highway corridors.

R2 Sensitive Species

Colorado River Cutthroat Trout

Regarding CRCT, *Oncorhynchus clarkii pleuriticus* is the specific subspecies warranting consideration as an R2 sensitive species. The hybrid cutthroat trout (*Oncorhynchus clarkii*) in Beaver Creek do not represent this subspecies, sufficiently genetically pure CRCT are not present in the project area, and the

¹⁵⁸ Stevens et al., 1996; Clevenger et al., 2002; Alexander et al., 2004, 2005; Ruediger et al., 2000

¹⁵⁹ Thompson, 2011

hybrid cutthroat that are present do not warrant consideration as an R2 sensitive species. Therefore, Alternative 2 would have no impact on CRCT.

With the implementation of Project Design Features and Best Management Practices (PDF/BMP) (see Table 2-1) Alternative 2 would be consistent with all applicable standards and guidelines the management objective, and Forest direction applicable to CRCT and water quality.¹⁶⁰

Boreal Western Toad

Alternative 2 project components would have no affect on any known or potential boreal toad breeding habitat or surrounding terrestrial habitats that could be expected to be used post-breeding or for hibernacula. With the implementation of standard BMPs incorporated Alternative 2 (see Table 2-1), no sediments originating in Alternative 2 construction areas are likely to extend to any suitable boreal toad breeding complex on NFS or private lands. It is discountable that extreme female home range or dispersing toad movements could extend over extreme geographical barriers from extant toad populations in adjacent drainages at the northern end of the Sawatch Range into the project area. As such, construction activity impacts (e.g., direct mortality of individuals in clearance areas and along access roads, direct effects) or impaired habitat connectivity via reduce forest cover and maintenance vehicle-induced mortality along mountain roads (indirect effects) would not impact individuals.

Therefore, Alternative 2 would have **no impact** on this species.

With the implementation of PDF/BMP that are part of the Proposed Action, Alternative 2 would be consistent with all standards and guidelines, the management objective and Forest direction applicable to boreal toads and leopard frogs.¹⁶¹

Northern Leopard Frog

There is no suitable leopard frog breeding habitat that would be directly affected by Alternative 2. For the same reasons described above under Alternative 2 for the boreal toad, direct and indirect, including the implementation of PDF/BMP, and effects associated with other reasonably foreseeable projects considered in this analysis would have **no impact** on the leopard frog.

Northern Goshawk

Alternative 2 would affect goshawks by removing forest cover within existing intertrail islands on NFS lands within the developed interior Beaver Creek's SUP area that supports potential prey species. Based on goshawk habitat associations, Alternative 2 would affect approximately 20.5 acres of potential

¹⁶⁰ USDA Forest Service, 2002e (as amended in 2006c and 2008e,a), 2002f, 2002e

¹⁶¹ Id.

goshawk habitat foraging for conventional ski trail development.¹⁶² No goshawk nests or nesting habitat associated with a known nesting block would be affected.

Regarding goshawks, Alternative 2 **may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.**

Northern Harrier

Alternative 2 could affect the availability and effectiveness of potential foraging habitat via a net gain of non-forested habitats as a result of forest clearing for ski trails. By itself, this effect would result in a “beneficial impact” determination. However, areas of currently effective, potential foraging habitat on ski trails that would be disturbed by snowmaking infrastructure installation would temporarily degrade those foraging habitats. Therefore, Alternative 2, accounting for implementation of PDF/BMP (Table 2-1), **may adversely impact individual harriers, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.**

American Peregrine Falcon

Under Alternative 2, the loss of forest cover associated with subalpine ski trail development should have no discernable adverse effect because the associated prey base below the canopy is unavailable to peregrines. Indeed, ski trail development under Alternative 2 may insignificantly benefit peregrines by increasing the quality of potential foraging habitat by creating additional openings that prey species would have to fly across (thereby increasing the vulnerability of forest and “edge” birds to peregrine predation) and by improving potential prey recovery habitat, for birds knocked down by peregrines above the former canopy. Peregrines are not particularly bothered by humans per se, so the summer construction and subsequent maintenance activities in project component areas and along access road corridors should have little adverse effect on the availability of the local prey base.¹⁶³ Because small areas of currently effective, potential foraging habitat would also be lost to snowmaking reservoir and storage buildings, overall potential effects would not be entirely beneficial.

The implementation of PDF/BMP (see Table 2-1) should have no effect on peregrine habitat use. Overall, Alternative 2 should have no meaningful effect on the peregrine falcon or its habitat. Regarding peregrine falcons Alternative 2 **may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.**

Boreal Owl

Alternative 2 would affect boreal owls by removing linear forest strips through and along the flanks of intertrail tree islands within the developed interior of the ski area. Affected forest could represent year-round foraging habitat and, to a lesser extent in larger intertrail islands, potential nesting habitat within

¹⁶² Rhea et al., 2006

¹⁶³ Craig, 2007

one or more owl home ranges. Potential boreal owl foraging habitat affected would total up to 19.1 acres. Loss of forest-interior prey may be partially offset during the snow free season by substantial increases in deer mice on newly created ski trails. Potential nesting habitat affected, largely associated with the three mature, closed canopy, conifer islands, would total up to 12.8 acres. Skiing activity through and adjacent to remaining intertrail islands, per se, should have no adverse effects on owls. The abundance of some prey species (small mammals and birds) may decline in an area larger than the area of tree removal as a result of tree removal, snow compaction, forest fragmentation effects, and greater tree skiing.

If boreal owl nests are detected within areas approved for disturbance, direct mortality of eggs and/or nestlings could be avoided by conducting tree removal in potential nesting habitat outside of the May 21 to July 15 nesting (with eggs/ young) period.

Regarding boreal owls, Alternative 2 **may impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend toward federal listing.**

American Three-Toed Woodpecker

Alternative 2 would affect three-toed woodpeckers by removing forest cover that supports potential foraging and nesting habitat within existing intertrail islands on NFS lands within the developed interior of Beaver Creek's SUP area. Based on three-toed woodpecker habitat associations, Alternative 2 would affect 20.5 acres of potential foraging and nesting habitat for conventional ski trail development.¹⁶⁴

If three-toed woodpecker nests are detected within the project area, direct mortality of current year recruitment could be avoided by conducting tree removal in potential nesting habitat outside of the March 14 to July 15 nesting period.

Regarding three-toed woodpeckers, Alternative 2 **may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.**

Olive-Sided Flycatcher

Alternative 2 would affect olive-sided flycatchers by removing forest cover that supports potential foraging and nesting habitat within existing intertrail islands on NFS lands within the developed interior of Beaver Creek's SUP area. As a worst case scenario, Alternative 2 would affect 20.5 acres of potential foraging and nesting habitat for conventional ski trail development, although < 50 percent of that area is potentially suitable habitat. Tree removal could be partly beneficial from a long-term, foraging habitat, perspective, if forest openings (i.e., ski trails reclaimed with native plants could support a higher prey base than that now present above the canopies. Conversely, existing, non-forested, foraging habitat (e.g., grasslands, meadows, and ski trails) adjacent to forest stands supporting the flying insect prey base of this

¹⁶⁴ Hoover and Wills, 1984

species could also be adversely affected (over short- to moderate-terms) by temporary construction disturbances.

If olive-sided flycatcher nests are detected within the project area, direct mortality of eggs and/or nestlings could be avoided by conducting tree removal in potential nesting habitat outside of the June 1 and July 15 nesting period.

Regarding olive-sided flycatchers, Alternative 2 **may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.**

Pygmy Shrew

Alternative 2 could impact individual pygmy shrews through direct, construction-related mortality and/or loss of potential and possibly occupied habitat. Loss of forest-interior prey may be partially offset during the snow free season by substantial increases in deer mice (potential prey) on newly created ski trails. The project area, including areas affected by PDF/BMP (Table 2-1), represent an insignificant proportion of the total potential range and habitat available to this species on the Forest. The probability that this species would be present in those potentially suitable habitats proposed for subalpine ski trail development, when it is so rare on the WRNF, is unlikely.

Nevertheless, because potential pygmy shrew habitat would be converted and disturbed, Alternative 2 **may adversely impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.**

American Marten

Alternative 2 would affect martens by removing linear forest strips, which represent foraging habitat and possible denning habitat, likely extending into portions of several individuals' home ranges. Affected forest cover, representing at least potential marten habitat, would total up to 19.1 acres. No known marten dens are present within disturbance areas; however marten dens are virtually impossible to locate without the use of radio-collared animals. Young-of-the year would be vulnerable to den tree removal that occurred between approximately March 1 and June 15.¹⁶⁵ The 12.8 acres of tree removal that would occur within the interiors of the three mature, closed canopy, conifer islands, referenced above under boreal owls, represents marginal, but potential, marten denning habitat. Because den selection, if not denning per se, generally begins before the ski season has ended, marten may not select den sites within areas currently used for tree skiing, although such daytime skiing when martens are asleep in their dens probably has little influence.

Marten habitat effectiveness may decline in an area larger than the area of tree removal as a result of fragmentation effects and tree skiing. The effects of tree skiing intertrail islands on the local forest prey

¹⁶⁵ Fitzgerald et al., 1994

base are unclear, but are unlikely to be beneficial. Loss of forest-interior prey would be partially offset during the snowfree season by substantial increases in deer mice on newly created ski trails.

Regarding American marten, Alternative 2 **may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.**

North American Wolverine

No known wolverine foraging, denning, travel, or security habitats would be affected by Alternative 2. The project area is unsuitable for wolverine denning because of the absence of isolated alpine habitat.¹⁶⁶ Unlike obligate forest carnivores, there is no terrain in the surrounding area that a wolverine could not physically negotiate at any season of the year. It is discountable that the dispersing wolverine from Montana would make its way to Beaver Creek and be in the area during construction activities to the extent that this one individual might be affected.

Regarding wolverine, Alternative 2 **may impact individuals, but is not likely to result in a loss of viability in the planning area, nor cause a trend toward federal listing.**

Management Indicator Species

American Elk

Alternative 2 would result in the conversion and reduced effectiveness of elk transitional and summer range within and adjacent to a relatively small acreage of project component areas within the developed interior of the ski area where elk habitat effectiveness is influenced daily by construction, maintenance, and recreational activities.

Habitat conversion of portions of intertrail tree islands within the developed interior of the ski area to conventional ski trails and temporary disturbances to existing ski trails would affect a relatively small amount of spring through fall elk foraging habitat whose effectiveness varies with proximity to maintenance and recreation corridors used daily during that interval. Habitat effectiveness of summer range in and adjacent to project component areas would also be reduced by habitat fragmentation and low levels of human activities (summer construction and maintenance). Construction activity displacement effects would persist for years and while full recovery cannot be assumed, it is possible that elk use could largely return to former levels after about seven years, as long as human use remains near current environmental baseline levels and trails are reclaimed with native seed mixes, as proposed.¹⁶⁷ Elk could theoretically benefit from increased forage availability on conventional ski trails, if disturbance areas along existing trail corridors (dominated by non-native cultivars) are reclaimed with native seed mixes, as proposed, as long as they are not displaced by human activity, although summer forage availability is not a limiting factor. Assuming full habitat occupancy at present, temporarily or permanently displaced elk

¹⁶⁶ Copeland, 1996

¹⁶⁷ Morrison et al., 1995

would compete with their cohorts in the Data Analysis Units (DAU) for the reduced, short- to long-term effectiveness of spring through summer habitats in and adjacent to project component areas. Alternative 2 development and facilities would not affect elk movement patterns or winter range availability and use.

Alternative 2 would be consistent with all applicable Forest Plan standards and guidelines, the management objective, and Forest direction related to elk.¹⁶⁸

Increased traffic on regional highways resulting from the 13-day the 2015 World Alpine Skiing Championships (February 3 to 15) is detailed in Canada Lynx Section above. The event would occur when elk are relatively sedentary on their lower elevation winter ranges. However, daily movements between bedding and foraging areas on those winter ranges can result in attempted crossings of high speed highways where animals and humans are susceptible to collisions resulting in highway mortality. For the Proposed Action, this is largely an issue along lower elevations of the Front Range (i.e., east of Floyd Hill, where the I-70 corridor is not continuously treated with restrictive fencing) and from Vail, down valley, where both sides of the I-70 corridor are continuously fenced specifically to minimize highway mortality. The event-related spike in regional highway volumes used by guests, volunteers, and participants to attend the WAC would result in a commensurate incremental increase on elk road-kill probabilities relative to Year 2015 baseline traffic volumes. Additional mitigation (see Table 2-1) has been developed for lynx that would further reduce regional highway traffic volumes, further reducing potential conflicts with elk.

Alternative 2 would not measurably contribute to any negative trend in the DAU or Forest-wide population or habitat trend of this MIS.

Aquatic Macroinvertebrates

Under Alternative 2, the implementation of PDF (refer to Table 2-1) would avoid and minimize potential erosion and sedimentation affects. Alternative 2 would continue to provide aquatic macroinvertebrate habitat across the existing ski area and would not measurably contribute to any negative trend in the Forest-wide population or habitat trend of this MIS that would affect achieving Forest Plan MIS objectives. Physical habitat quality would be maintained in its current condition under Alternative 2. Alternative 2 is not expected to generate any secondary development or dispersed recreation effects from additional residents, employees, or guests that would affect this indicator group or water quality in the analysis area. While past and present actions have modified some project area stream channels (e.g., Westfall Creek) to some extent, aquatic faunal communities downstream in Beaver Creek remain in robust condition compared with control streams.

The Forest Service will continue monitoring this MIS to establish and track its population and trend across the Forest. Stream conditions on the WRNF as a whole are generally in good (i.e., somewhat near

¹⁶⁸ USDA Forest Service, 2002e,f, 2005d

reference) condition and Forest-wide aquatic macroinvertebrates are expected to be maintained or move toward reference (i.e., better) conditions as more conservative habitat protection measures are implemented and as habitat improves.

All Trout (brook, brown, rainbow, & Colorado River cutthroat)

Under Alternative 2, water quality-related PDF (refer to Table 2-1) would be required and implemented to avoid, minimize, and mitigate adverse effects to aquatic habitat within and below the project area. Alternative 2 would result in short-term and permanent, minor, localized, ground disturbing activities (creek culverting and stream restoration, disturbances within the WIZ, tree removal, grading of some trails, snowmaking water line installation, building installation, etc.) and increased water yield and peak streamflow (short- to long-term from additional snowmaking and tree removal) with the potential to increase erosion, sedimentation, and local slope failures that could extend to local creeks and cause changes to the hydrology, aquatic habitat, and trout communities within project area streams.

Onsite project effects would largely be confined to the Westfall Creek drainage, a second-order, high gradient, tributary of Beaver Creek located within the developed interior of Beaver Creek Resort. The result would be minor perturbations to local, seasonal trout habitat and potential and occupied spawning reaches from environmental baseline conditions within this local portion of the project area and within stream reaches on NFS and non-NFS lands affected by compensatory water releases.

Alternative 2 would be consistent with all applicable WRNF standards and guidelines and the Watershed Conservation Practices Handbook (FSH 2509.25). The implementation of Alternative 2, with PDF would neither contribute towards, nor negatively affect, meeting aquatic MIS objectives at the Forest-wide scale. Physical habitat quality would be maintained in its current condition under Alternative 2. Long-term effects to trout populations as a result of proposed activities would not result in any measurable population trends at the project or Forest-wide scale. Alternative 2 is not expected to generate any secondary development or dispersed recreation effects from additional residents, employees, or guests that would affect this MIS group or their habitat in the analysis area.

CUMULATIVE EFFECTS

Appendix A includes a list of past, present, and reasonably foreseeable future projects have been identified by the Forest Service as relevant from a cumulative effects context.

Temporal and Spatial Extent of Analysis

The temporal extent of the analysis commences with conditions existing before the development of Beaver Creek in 1980, extend through the history of Beaver Creek to the present, and includes the lifespan of current proposed projects as well as those that are current reasonably foreseeable future actions, in general 10 to 20 years into the future from the date of this document.

Individual species are discussed, below.

Federally Listed Species

Canada Lynx

Most of the cumulative effects warranting consideration for lynx under NEPA are those ongoing activities and approved projects in the environmental baseline considered above under Existing Conditions. However, other current and future federal actions that may also affect lynx warrant consideration.

Because of MPB effects, the Forest Service has approved a variety of vegetation treatments on 553 acres within the Beaver Creek SUP area. Virtually all of these treatment areas have been recently reclassified as “currently unsuitable” lynx habitat in the Forest Service’s updated environmental baseline statistics for LAU 20 that reflect the results of the MPB epidemic. The project involves salvaging standing dead and dying MPB-infested lodgepole trees that have been and will be killed by MPBs. Such trees have little present and subsequent value to the lynx prey base. Thus, the habitat conversion that has and will occur (and the resulting changes in LAU statistics) is a result of the beetles, not the removal of the dead trees. The broader effects of the MPB epidemic in the Eagle Valley LAU have been considered as part of the environmental baseline.

With respect to lynx, implementation of treatments would better insure forest regeneration where lynx may occasionally be present. This should provide a moderate- to long-term, potential benefit to lynx as forest succession creates higher quality habitat for the prey base than what is now present (and what was recently present), assuming that forest regeneration is not pruned by skiers. The project per se would have few potential adverse effects (e.g., lynx displaced from active treatment areas, insignificant increases in project-related road-kill probabilities on regional highways, etc.) on lynx or its habitat.

Traffic on Colorado’s major east-west transportation corridor is becoming a major issue. The CDOT and the FHA began analyzing alternatives for the I-70 Mountain Corridor Project in January 2000 to address the underlying need to reduce congestion and improve mobility and accessibility on I-70 between Glenwood Springs and C-470. The I-70 Mountain Corridor Draft PEIS was undertaken because existing congestion along I-70 is degrading the accessibility of mountain travel for Colorado residents, tourists, and businesses, with projected increases in travel demand over the next 25 years and beyond. The Tier 1 ROD for the I-70 Mountain Corridor Draft Programmatic EIS was signed Federal Highway Administration (FHA) on June 16, 2011.

The PEIS identified that the need to relieve I-70 congestion is especially acute for extended weekend travelers seeking access between the Denver metropolitan area and U.S. 40 (to Grand County), as well as through the Eisenhower Tunnel to the Western Slope. The selected alternative is expected to result in greater accessibility to mountain communities along the I-70 corridor, benefiting Summit and Eagle County economies, as well as ski areas.

With respect to lynx, it is likely that the selected action will meet its goal of accommodating greater traffic volumes at higher speeds. Where such upgraded highway sections bisect lynx habitat, the effect will be greater lynx highway mortality probabilities, impaired local and landscape-level habitat connectivity across the highway, and reduced habitat effectiveness adjacent to the highway. These adverse effects will be partly offset with the implementation of conservation measures, including, but not limited to highway crossing structures.

R2 Fish

Colorado River Cutthroat Trout

Past actions in the vicinity of the project area, including introductions of non-native trout, fishing pressure, habitat modifications (possibly including ski area development if CRCT were still present in 1979 when the ski area was initially developed), water diversions, logging, road building, and overgrazing have adversely affected CRCT habitat and probably resulted in the local extirpation of pure strains of this native trout from analysis area creeks. Present actions, including, but not limited to ongoing residential development, summer construction projects on the ski area, and dispersed recreation at elevations overlapping potential cutthroat trout habitat, have likely been limited to minor additional impacts (runoff and other water quality impacts) to historic, currently unsuitable, and unoccupied CRCT habitat.

The 1998 Snowmaking Expansion project is a reasonably foreseeable action that could affect historic, currently unsuitable, and unoccupied CRCT habitat via habitat conversion, ground disturbance, erosion, sedimentation, increased runoff (short- to long-term), and other negative water quality impacts.

R2 Amphibians

Boreal Western Toad

Past actions and present actions in the vicinity of the project area, including ski area and secondary base area developments, logging and road building, water diversions, recreational trails and use, and the continuing chytrid fungus and MPB trends have adversely affected habitat that falls within the broad continuum used elsewhere by boreal toad. While it is likely that boreal toad historic habitat overlapped the Beaver Creek drainage, there is no evidence that boreal toads are now present in the drainage and the most suitable, potential, but apparently unoccupied habitats would be located at higher elevations of the drainage, beyond the influence of the Proposed Action. Present actions (ongoing residential, base area, and secondary ski area developments, summer construction projects on the ski area, traffic on local roads, and dispersed recreation at elevations overlapping potential boreal toad habitat) have likely contributed minor, additional impacts to possibly historic, but currently unoccupied and unsuitable boreal toad habitat. As such, the resulting potential impacts including forest clearing and fragmentation that could affect terrestrial toad movements, hibernation location, the quality of aquatic breeding sites, traffic resulting in toad mortality during pre- and post-breeding toad movements, and dispersed recreation

resulting in mortality risks and the inadvertent spread of chytrid fungus between breeding sites would have no impact on this species.

The 1998 Snowmaking Expansion project is a reasonably foreseeable action that could affect boreal toads. However, this would affect possibly historic, but currently unoccupied and unsuitable boreal toad habitat.

Northern Leopard Frog

Past actions (see boreal toad discussion) may have adversely affected historic, occupied, and/or potential northern leopard frog habitat in the vicinity of the project area. Present actions may have contributed minor, additional impacts to potential, but unoccupied leopard frog habitat. Reasonably foreseeable actions would not affect suitable habitat of this species.

R2 Birds

Northern Goshawk and Northern Harrier

Past and present actions, largely associated with ski area and secondary residential development in the Beaver Creek goshawk project area, along with historic mining and logging and more recent secondary residential development and increased dispersed recreational use, have adversely affected goshawk and harrier foraging and possible nesting habitat through habitat conversion, fragmentation, loss, and human disturbance. However, goshawks and harriers likely persist across the northern end of the Swatch Range.

The 1998 Snowmaking Expansion project is a reasonably foreseeable action that could affect goshawks and harriers. This could contribute additional adverse effects to foraging, but not potential nesting habitat along the northern end of the Swatch Range. However, both bird species would persist in this analysis area. Other reasonably foreseeable projects considered in this analysis would contribute no additional cumulative effects to these species because impact zones associated with those other projects would not extend to potential habitat for this species that could be directly and indirectly affected by Alternative 2 on NFS land.

American Peregrine Falcon

Past and present actions have adversely and beneficially affected peregrine falcon habitat viability in the vicinity of the Beaver Creek analysis area. Significant adverse effects included (1) historic organochlorine pesticide use throughout the migratory range of the species that impaired recruitment and led to the decline of the overall species in North America, (2) historic local (Gilman) mining effects that resulted in habitat conversion and locally decreased prey populations, and (3) upgrades to the National highway systems that led to resort and secondary development that converted large areas of former hunting habitat along the Eagle River Valley bottom to non-functional habitat and increased human activity levels throughout surrounding habitats. The local nesting pair have recovered from pesticides and adapted to the widespread habitat and disturbances such that they may be at full habitat occupancy, limited by the

distribution of suitable nesting cliffs. Closer to the project area, development of Vail and Beaver Creek ski areas that created grasslands out of closed canopy forest may have potentially benefitted peregrines by creating additional openings that prey species would have to fly across (thereby increasing the vulnerability of forest and “edge” birds to peregrine predation) and increasing the quality of potential foraging habitat (by improving potential prey recovery habitat, for birds knocked down by peregrines above the former canopy). This potential, insignificant benefit somewhat distant from more concentrated prey populations along the Eagle River may have been unrealized before (pre-1960) peregrine populations had recovered from persistent pesticides and may be realized in recent years (post mid-1990s) with the reoccupancy of the local eyrie. Cables associated with existing ski lifts do not represent a meaningful collision hazard.¹⁶⁹

The 1998 Snowmaking Expansion project is a reasonably foreseeable action that could affect peregrine falcons. This project could contribute additional, insignificant benefits to potential foraging habitat along the northern end of the Swatch Range. Other reasonably foreseeable projects considered in this analysis would contribute no additional cumulative effects to this species because impact zones associated with those other projects would not extend to potential habitat for this species that could be directly and indirectly affected by Alternative 2 on NFS land.

Boreal Owl, American Three-toed Woodpecker, and Olive-sided Flycatcher

Past and present actions, largely associated with ski area development in the Beaver Creek SUP area, along with historic logging and mining, have adversely affected suitable foraging and nesting habitat through habitat conversion, fragmentation, loss, and incomplete successional recovery. However, all four of these bird species likely persist across the northern end of the Sawatch Range, and may occur in large enough blocks of developed ski terrain.

The 1998 Snowmaking Expansion project is a reasonably foreseeable action that could affect boreal owl, American three-toed woodpecker, olive-sided flycatcher, and pygmy shrew. This project could contribute additional adverse effects to foraging, but not potential nesting habitat within the developed interior of the ski area. However, all of these species would persist in this analysis area. Other reasonably foreseeable projects considered in this analysis would contribute no additional cumulative effects to these species because impact zones associated with those other projects would not extend to potential habitat that could be directly and indirectly affected by Alternative 2 on NFS land.

R2 Mammals

Pygmy Shrew

Past and present actions, largely associated with ski area development in the SUP area, along with historic logging and mining, have adversely affected suitable foraging and denning habitat for this species through

¹⁶⁹ Craig, 2007

habitat conversion, fragmentation, loss, and incomplete successional recovery. However, large areas of potential pygmy shrew habitat extend across along the northern end of the Sawatch Range and occur in some intertrail islands within the developed interior of the ski area.

The 1998 Snowmaking Expansion project is a reasonably foreseeable action that could affect pygmy shrew. This project could contribute additional adverse effects to potential pygmy shrew habitat within the developed interior of the ski area. However, large areas of potential pygmy shrew habitat would persist in this analysis area. Other reasonably foreseeable projects considered in this analysis would contribute no additional cumulative effects to this species because impact zones associated with those other projects would not extend to potential habitat for this species that could be directly and indirectly affected by Alternative 2 on NFS land.

American Marten

Past and present actions, largely associated with ski area development in the Beaver Creek SUP area, along with historic logging and mining, have adversely affected suitable marten foraging and denning habitat through habitat conversion, fragmentation, loss, and incomplete successional recovery. However, marten persist across along the northern end of the Sawatch Range and in larger intertrail islands across the spruce-fir and mixed conifer zones within and beyond the developed interior of the ski area.

The 1998 Snowmaking Expansion project is a reasonably foreseeable action considered herein that could affect martens. This project could contribute additional adverse effects to foraging, but not potential denning habitat within the developed interior of the ski area (i.e., because proposed tree clearing are currently skied, partly gladed, relatively small, lower elevation, intertrail islands within the developed interior of the ski area that are unsuitable as denning habitat). However, marten would persist in the Beaver Creek analysis area. Other reasonably foreseeable projects considered in this analysis would contribute no additional cumulative effects to this species because impact zones associated with those other projects would not extend to potential habitat for this species that could be directly and indirectly affected by Alternative 2 on NFS land.

North American Wolverine

Past and present actions have adversely affected wolverine habitat potential in the Beaver Creek analysis area. Most of these adverse effects were to vacant habitat that has likely been unoccupied since historic times.¹⁷⁰ Significant adverse effects included (1) upgrades to the National highway system that impaired landscape connectivity and isolated large habitat blocks, (2) municipal, resort, and secondary development along transportation corridors that converted large areas of former big game winter ranges along valley bottoms containing transportation corridors to non-functional habitat, further barriers to wolverine movements, and increased human activity levels throughout surrounding habitats, (3) improved

¹⁷⁰ Bissell, 1978a; Halfpenny, 1981; Seidel et al., 1997; Aubry et al., 2007

communication systems allowing year-round residential persistence in the mountains, (4) historic mining and logging, historic hunting and trapping, and more recent dispersed backcountry recreation.¹⁷¹

The 1998 Snowmaking Expansion project, and the I-70 Mountain Corridor Programmatic EIS, are reasonably foreseeable actions that could affect wolverines. These projects could contribute additional adverse effects to unlikely to be used travel habitat through the developed interior of the ski area. With respect to I-70 upgrades, it is likely that the selected action will meet its goal of accommodating greater traffic volumes at higher speeds. Where such upgraded highway sections bisect linkages where wolverine would be unlikely (i.e., because of their extreme adversity to crossing highways), but most likely (i.e., of any other location on the landscape), the effect will be insignificantly greater highway mortality probabilities, insignificantly greater impaired local and landscape-level habitat connectivity across the highway, and insignificantly greater reduced habitat effectiveness adjacent to the highway. These adverse effects may be partly offset with the implementation of conservation measures, including, but not limited to highway crossing structures. Other reasonably foreseeable projects considered in this analysis would contribute no additional cumulative effects to this species because impact zones associated with those other projects would not extend to potential habitat for this species that could be directly and indirectly affected by Alternative 2 on NFS land.¹⁷²

Management Indicator Species

American Elk

Reasonably foreseeable actions considered herein that could affect elk that could also be affected by Alternative 2 would include the 1998 Snowmaking Expansion and implementation of the I-70 Mountain Corridor Programmatic EIS. These projects could contribute additional, adverse effects to relatively small, local areas within the developed interior of the ski area where elk habitat effectiveness is influenced daily by construction, maintenance, and recreational activities. With respect to I-70 upgrades, it is likely that the selected action will meet its goal of accommodating greater traffic volumes at higher speeds. Where such upgraded highway sections bisect daily and seasonal elk movements, the effect will be insignificantly greater highway mortality probabilities, insignificantly greater impaired local and landscape-level habitat connectivity across the highway, and insignificantly greater reduced habitat effectiveness adjacent to the highway. These adverse effects may be partly offset with the implementation of conservation measures, including, but not limited to highway crossing structures and/or restrictive fencing. Other reasonably foreseeable projects considered in this analysis would contribute no additional cumulative effects to this species because impact zones associated with those other projects would not extend to potential habitat for this species that could be directly and indirectly affected by Alternative 2 on NFS land.¹⁷³

¹⁷¹ Armstrong, 1972

¹⁷² Thompson, 2011; USEPA, 1999

¹⁷³ Id.

Aquatic Macroinvertebrates

Past and present actions that have affected aquatic macroinvertebrates and their habitat in the analysis area include ski area development and maintenance, with considerably more minor affects resulting from historic mining, historic logging, and summer recreational activities. These actions have modified stream channels to some extent and resulted in short-term to long-term perturbations to water quality and aquatic faunal communities compared with control streams. Watersheds subjected to activities associated with ski area management, particularly trail construction and snowmaking, tend to exhibit cumulative changes to channel conditions, with differing, corresponding dynamic equilibria, as compared to watersheds in undeveloped conditions. These changes are caused by increases in peak snowmelt magnitude and duration due to the effects of trail clearing, trail grading, and snowmaking. Affected channel reaches typically exhibit long term, continuing adjustments to their dynamic equilibria due to accelerated water inputs caused by both snowmaking and trail construction.

Reasonably foreseeable actions considered herein that could affect aquatic macroinvertebrates or water quality that could also be affected by Alternative 2 would include the 1998 Snowmaking Expansion and implementation of the Beaver Creek Beetle Tree Salvage and Vail/Beaver Creek Bug Tree Projects. These projects could contribute additional, local, adverse effects to this indicator group and water quality in the analysis area as a result of the additional removal of currently stabilizing native vegetation within the WIZ and additional snowmaking increasing water yield and peak flows. With respect to the latter projects, about 6 acres of the 115 acres of treatment within the study area would occur within currently forested WIZ. Implementation of the MPB Treatment Project could increase water yield on the study area by approximately 5 percent relative to existing conditions. However, it is expected that recovery of treated areas would occur over time, thus reducing water yields in the long-term. Cumulative effects resulting from implementation of the MPB Treatment are not expected to diminish stream health or water quality within the study area. Furthermore, with continued implementation of water quality-related PDF that would likely be required for these projects, future degradation would be minimized. Other reasonably foreseeable projects considered in this analysis would contribute no additional cumulative effects to this MIS because impact zones associated with those other projects would not extend to project area streams and potential habitat for this MIS that could be directly and indirectly affected by Alternative 2 on NFS land.¹⁷⁴

All Trout (brook, brown, rainbow, & Colorado River cutthroat)

Past actions have had mostly negative effects to native trout and their habitat and beneficial and negative effects to the non-native trout considered in this MIS group. Past and present actions that have affected MIS trout and their habitat in the analysis area include ski area development and maintenance, with considerably more minor affects resulting from historic mining, historic logging, secondary resort development, water diversions and impoundments, summer recreational activities (e.g., water quality

¹⁷⁴ Id.

effects from trails as well as fishing pressure), and (most likely after the fact) CDOW management (i.e., restocking). Pre-CDOW introductions of non-native brook, brown, and rainbow trout into Colorado in the late 1800s clearly benefitted these species, while these same introductions and other factors adversely affected CRCT. These actions have modified stream channels and aquatic habitat conditions to some extent and resulted in short-term to long-term perturbations to water quality and quantity compared with control streams.

Reasonably foreseeable actions considered herein that could affect MIS trout that could also be affected by Alternative 2 would include the 1998 Snowmaking Expansion and implementation of the Beaver Creek Beetle Tree Salvage and Vail/Beaver Creek Bug Tree Projects. These projects could contribute additional, local, adverse effects to trout habitat in the analysis area as a result of the additional removal of currently stabilizing native vegetation within the WIZ and additional snowmaking increasing water yield and peak flows. With respect to the latter projects, about 6 acres of the 115 acres of treatment within the study area would occur within currently forested WIZ. Implementation of the MPB Treatment Project could increase water yield on the study area by approximately 5 percent relative to existing conditions. However, it is expected that recovery of treated areas would occur over time, thus reducing water yields in the long-term. Cumulative effects resulting from implementation of the MPB Treatment are not expected to diminish stream health or discernibly affect trout habitat within the study area. Furthermore, with continued implementation of the Beaver Creeks Drainage Management Plan and water quality-related PDF that would likely be required for these projects, future trout habitat degradation would be minimized. Other reasonably foreseeable projects considered in this analysis would contribute no additional cumulative effects to this MIS because impact zones associated with those other projects would not extend to project area streams and potential habitat for this MIS that could be directly and indirectly affected by Alternative 2 on NFS land.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Tree removal related to the proposed project would represent an irretrievable effect to wildlife habitat for species that use such habitats within the SUP area. However, this is not considered an irreversible commitment because overstory vegetation is a renewable resource.

G. VEGETATION

SCOPE OF THE ANALYSIS

The project area considered in this analysis is within Beaver Creek's 3,849-acre SUP area. For the sake of brevity, disturbance areas are defined below.

Per the 2002 Forest Plan, the SUP is designated as an 8.25 Management Area (Ski Areas – Existing and Potential), which is intensively managed for downhill skiing opportunities and opportunities for non-motorized recreation.¹⁷⁵ A wide variety of habitats occur in the project area. These habitats include barren, forblands (almost entirely ski trails), spruce/fir, lodgepole pine, aspen, douglas-fir, blue spruce, cottonwood, willows, sagebrush, and true mountain mahogany. To appropriately evaluate potential project effects of varying scale on different botanical species, different analysis areas are considered, depending on the species.

A Biological Assessment (BA) and Biological Evaluation (BE) were prepared for this project. Both documents are part of the project file (at the Holy Cross Ranger District) and are incorporated herein by reference.¹⁷⁶

Disturbance Areas

Disturbance areas represent the smallest quantitative analysis areas and the immediate areas of physical habitat modifications (i.e., habitat conversion). For the purpose of keeping this vegetation analysis succinct, the specific areas proposed for disturbance are discussed here. All project areas are identified on Figure 2.

- The proposed Birds of Prey Women's Downhill Course area would be comprised of existing trails (*Flattops* and *Peregrine*) and throughout forested intertrail islands. The islands are northeast-facing slopes with mature, closed-canopy, spruce-fir (*Picea engelmannii*-*Abies bicolor*) and ground vegetation dominated by myrtleleaf blueberry (*Vaccinium myrtillus*), parrot's beak (*Pedicularis parryi*), and heartleaf arnica (*Arnica cordifolia*). The lodgepole component in most of these islands has been affected to some extent by the Mountain Pine Beetle (MPB) with up to 60 percent mortality in local areas.
- The proposed women's Giant Slalom course on Grouse Mountain is also made up of existing trails (*Raven Ridge* and *Golden Eagle*) and inter-trail islands. A vegetation community of note in the proposed area is the alder (*Alnus tenuifolia*, 2C)/willow (*Salix planifolia*)/blue spruce (*P. pungens*, 2-4B) community flanking a first-order creek on the skier's left side of *Peregrine* above the *Golden Eagle* trail.

¹⁷⁵ USDA Forest Service, 2002a,b

¹⁷⁶ USDA Forest Service, 2008b,c

- The existing Birds of Prey Men's Downhill Course is made up of existing trails (*Zoom Room* and *Golden Eagle*), with some forested edges proposed for trail widening and snowmaking infrastructure improvements. A perennial, first-order creek surrounded by herbaceous riparian vegetation is also located just below Westfall Road on the existing *Golden Eagle* trail.
- The proposed spectator access trail to the Birds of Prey course from *Centennial* to *Goshawk* is currently a mature, closed- and open-canopy spruce-fir stand paralleling and just below the existing *Centennial* to *Goshawk* catwalk.
- The Red Tail Camp area has been regularly disturbed over the years and supports a sparse, weedy, non-native grassland on shallow gravelly soils. A narrow band (0.3 acre) of mature, closed canopy, aspen also surrounds the existing Red Tail Camp guest service facility.
- The proposed water tank site is on the edge of the existing *Paint Brush* trail below the *Beaver Creek Expressway*. In addition to a portion of the developed *Paint Brush* trail the water tank site covers the edge of a mature, closed- and open-canopy aspen stand with a relatively lush, largely herbaceous understory and moist areas supporting wetland species.

AFFECTED ENVIRONMENT

Vegetation communities within Beaver Creek's SUP area are provided in Table 3G-1. The majority (67.8 percent) of the SUP area is forested with virtually all of the remaining terrain in conventional ski trails. Lodgepole pine stands that are being affected by the MPB epidemic compose 21.8 percent of the SUP area.

**Table 3G-1:
Vegetation Communities and Acreage within the Beaver Creek SUP Area**

Vegetation community	Acres (%)
Barren (NBA)	12.19 (0.3)
Forblands (FOR, almost entirely ski trails)	1,155.14 (30.9)
Spruce-fir (TSF)	896.13 (24.0)
Lodgepole Pine (TLP)	815.68 (21.8)
Aspen (TAA)	784.1 (21.0)
Douglas-fir (TDF)	8.3 (0.2)
Blue spruce (TBS)	28.64 (0.8)
Cottonwood (TCW)	8.6 (0.2)
Willows (SWI)	11.38 (0.3)
Sagebrush (SSA)	2.93 (0.1)
True mountain mahogany (SMS)	12.9 (0.3)
Total	3,735.98 (100)

Source: USFS 2011, SE Group, and Western Ecosystems, Inc. Not field verified.

Mountain Pine Beetle Effects

A MPB epidemic has been advancing through this portion of Eagle County (as well as other areas), affecting the lodgepole pine component of forest stands. Depending on the species make up of the specific stand, the MPB epidemic may result in stand regeneration, replacement, or reduced stand density. Most of the Beaver Creek Mountain Improvements project area consists of spruce-fir habitat that will not be affected by MPB.

Noxious Weeds

Colorado Class A and B noxious weeds were detected on and adjacent to Beaver Creek Mountain Improvements project component areas (Table 3G-2). Noxious weed infestations are most common at lower project area elevations, including throughout the Red Tail Camp area, up *Redtail*, throughout the existing corridor off of *Redtail*, down the mountain access road through Red Tail Camp, down to the Village, up to the proposed Water Tank, down the *Paint Brush* trail, and up to Beano's Cabin. Otherwise, noxious weeds are limited to small, isolated patches in the project component areas and along intervening mountain roads. Table 3G-2 identifies noxious weeds that are present in the project area (the BE includes a complete list of noxious weeds with potential presence in the project area).

Table 3G-2:
Colorado Class A and B Noxious Weeds in the Project Area

Symbol	Scientific Name	Noxious Common Name	Colorado Noxious Weed Status ^a
ANCO2	<i>Anthemis cotula</i>	Mayweed chamomile	BW
CANU4	<i>Carduus nutans</i>	Musk thistle	BW
CIAR4	<i>Cirsium arvense</i>	Canada thistle	BW
CIVU	<i>Cirsium vulgare</i>	Bull thistle	BW
LELA2	<i>Lepidium latifolium</i>	Perennial pepperweed	BW
CHLE80	<i>Chrysanthemum leucanthemum</i>	Oxeye daisy	BW

^a AW = A list (noxious weeds), BW = B list (noxious weeds).

^b Weed locations are identified on figures and .klm files associated with the Rare Plant Species Field Survey forms that are part of the project file.

Source: <http://plants.usda.gov/java/noxious?rptType=State&sort=status&statefips=08>, accessed July 19, 2011.

Threatened and Endangered Plant Species

Only 1 of the 13 threatened and endangered plants federally listed for Colorado has been documented in the East Zone of the WRNF.¹⁷⁷ The threatened plant—Penland alpine fen mustard (*Eutrema penlandii*)—is endemic to Colorado and only found in the Mosquito Range from Hoosier Pass to Weston Pass in Park and Summit counties at elevations of 11,800 to 12,800 feet.¹⁷⁸ This mustard is found above 11,800 feet in rocky crevices on the side of mountain crests where deep wind-deposited snow accumulates and where

¹⁷⁷ USFWS, 1993

¹⁷⁸ Spackman et al., 1997; Thompson, 2011

there is moisture during the growing season, and rooted in mosses on stream banks, in hummock areas, or other sub-irrigated mossy areas.¹⁷⁹

This species and its potential habitat were not located during four systematic plant surveys conducted throughout all potential Proposed Action disturbance areas.

Region 2 Sensitive Plant Species

The Forest Service Region 2 (R2) has designated “sensitive species,” representing species declining in number or occurrence or whose habitat is declining, either of which could lead to federal listing if action is not taken to reverse the trend, and species whose habitat or population is stable but limited.¹⁸⁰ The updated R2 Sensitive Species List was refined by the WRNF to produce a subset of sensitive species, including 35 plants, that may be present or potentially present on the WRNF after an analysis of all sensitive species on the overall updated R2 list (refer to Table 3G-3).¹⁸¹ Determination of risks to population of sensitive plants takes into account the size, density, vigor, habitat requirements, locations of the population, and consequence of adverse effects on the species as a whole within its range and within the WRNF.

In 2011 botanical surveys were conducted for federally listed and R2 sensitive plants through all project areas that could potentially support such species. The purpose of the surveys was to gain a better understanding of the nature of the action(s), identify and characterize habitat types, structural stages, and potentially affected plant communities, and search for the plant species considered in this document.

Five R2 sensitive plant species (trianglelobe moonwort, slender moonwort, peculiar moonwort, yellow lady’s slipper and dwarf raspberry) have potentially suitable habitat in the project area. The remaining 30 R2 plant species do not occur in the habitats present in the project area, do not have elevation and/or distributional ranges that overlap the project area, have not been documented in the general geographic area of the project area, would not be affected by the Proposed Action, and do not warrant detailed consideration. Additional information on R2 sensitive species is contained in the BE.

Slender Moonwort

Moonworts are small, inconspicuous, and often ephemeral species, which may not appear above the ground every year. Throughout its distribution, slender moonwort occurs from sea level to 10,640 feet.¹⁸² In Colorado, the four extant populations range from 8,700 to 10,640 feet.¹⁸³ A description of typical habitat for the species is problematic because known sites are so different, but the USFWS characterizes the habitat as a variety of montane forest (openings) or meadow habitats, particularly early successional

¹⁷⁹ Roy et al., 1993

¹⁸⁰ Thompson, 2011

¹⁸¹ Ibid.

¹⁸² Ibid.

¹⁸³ Ibid.

and other stabilized ruderal habitats (e.g., roadsides, pipeline and powerline corridors, ski trails, etc.).¹⁸⁴ Due to the small size of slender moonwort and its scattered habitat availability, this species may be more abundant than is presently known. Slender moonwort produces spores from July to August and is most visible during the months of July and August. Threats to moonworts include surface disturbing activities that may physically change soils or moisture. Ski trail development through closed-canopy forests in Colorado has benefited moonworts by creating potential habitat out of previously unsuitable habitat, as ski runs are known to provide habitat for moonwort species.¹⁸⁵

The project area contains some ski trails that support suitable moonwort habitat. Some of that potential moonwort habitat is sparsely, and locally occupied by a low diversity of non-R2 moonwort species (i.e., *B. echo*, *B. minganense* and *B. neolunaria* totaling seven individuals). Beaver Creek is a relatively young ski area, and it may support moonwort abundance and diversities common on other older ski area in the future. Conversely, Beaver Creek's trails were virtually all developed by grading (as opposed to flush-cutting) resulting in coarser soils that are less favorable to some moonwort species. Furthermore, ski trails in the project area are xeric (also less favorable to some moonworts) and many are dominated by dense, smooth brome patches with a dense thatch layer where moonworts are rarely found.¹⁸⁶

While botanical surveys of the project area conducted at a time of year when slender moonwort would have been most detectable did not locate this species, other moonworts and suitable, but unoccupied moonwort habitat, and/or habitat where moonworts are not expressed above the ground, were located. It is possible, though extremely unlikely, that slender moonwort spores are present, but that the plants have not emerged. General USFS direction is that unoccupied (as determined by appropriate surveys), but apparently suitable, potential R2 sensitive plant habitats are considered to be occupied, based on the rationale that if habitats actually were suitable, they would be occupied. Therefore, impacts to unoccupied habitats would have "no impact" on R2 sensitive plants. However, because moonwort spores may remain unexpressed below ground for years before plants emerge and can be detected, this general USFS direction is not applicable to moonworts.

Trianglelobe Moonwort

The distribution of trianglelobe moonwort (*Botrychium ascendens*) ranges from southeastern Alaska to California, Nevada, Utah, Colorado, and Wyoming.¹⁸⁷ Trianglelobe moonwort habitat includes wetlands, wetland edges, and montane willow communities with high moss, gravel and cobble ground cover. Trianglelobe moonwort shares other life history characteristics with slender moonwort, described above. Trianglelobe moonwort was not detected during plant surveys of the project area, however, portions of the project area support some of the ruderal habitats in which this species is generally associated.

¹⁸⁴ Ibid.

¹⁸⁵ Thompson, 2003a

¹⁸⁶ Thompson, 2003c

¹⁸⁷ Thompson, 2011

Paradox Moonwort

Paradox moonwort (*Botrychium paradoxum*) has been found in only a few, widely scattered sites in the western United States and southwestern Canada.¹⁸⁸ In the United States, it has been documented in Idaho, Montana, Oregon, Utah, Washington, Wyoming, and Colorado. Elevation range of the plant is approximately 9,000 to 12,500 feet. Paradox moonworts are found in montane to subalpine grassy meadows and open areas. Similar to other moonworts, potential habitat for the paradox moonwort is located in ruderal habitats such as ski trails, old landings, skid trails, roadsides, under conifer saplings, meadows, and other clearings. Paradox moonwort is most visible during the months of July and August. Paradox moonwort was not detected during plant surveys of the project area, however, portions of the project area support some of the ruderal habitats in which this species is generally associated.

Yellow Lady's Slipper

Yellow lady's slipper (*Cypripedium parviflorum*) is an orchid known from all Canadian provinces and most U.S. states, except Nevada, Texas, Louisiana, and Florida. Although widespread, it is uncommon in most of its range. In Colorado, it grows in aspen groves and ponderosa pine/Douglas-fir forests, riparian and riparian transition, cottonwood, lodgepole pine, and spruce-fir forests up to the alpine zone, with an approximate upper elevation limit of 12,500 feet. Sizeable populations occur on the east slope of the Front Range, but elsewhere in Colorado, they are limited to plants in a few scattered patches.¹⁸⁹ According to Spackman et al., this species has not been documented in Eagle County.¹⁹⁰ The closest known population to the project area is in the vicinity of Carbondale. Recent records of this species within the Beaver Creek SUP area were likely misidentified *Cypripedium fasciculatum* (a former R2 sensitive plant, currently a Species of Local Concern), which is locally common in the SUP and project areas. Yellow lady's slipper flowering may range over a 10 week period from May through August, depending on local environmental conditions, and flowers may remain open for up to three weeks. Habitat falling within the general continuum of this species is present within the project area, but the species was not located and is considered to be absent in the project area.

Dwarf Raspberry

Dwarf raspberry (*Rubus arcticus* ssp. *acaulis*) is a small herbaceous wetland plant that is restricted to North America and possibly Siberia.¹⁹¹ Although it is a relatively widespread species, occurrences of dwarf raspberry are few and tend to be widely separated within the continental United States. In Region 2, this species is known from mountainous areas in Colorado and Wyoming. Eight of the ten documented occurrences in Colorado and Wyoming are on NFS lands. In Colorado, two occurrences are on the Pike National Forest and three are on the Arapaho National Forest. The Colorado Natural Heritage Program designates it critically imperiled (S1) in Colorado. In Colorado and Wyoming, dwarf raspberry grows in

¹⁸⁸ Ibid.

¹⁸⁹ Spackman et al., 1997

¹⁹⁰ Ibid.

¹⁹¹ Ladyman, 2006

the montane and sub-alpine, at elevations between approximately 7,000 and 9,720 feet. This species can grow at forested wetlands, willow carrs, mossy stream-sides, mountain meadows, and alpine tundra. Although clearly found in tundra in the northern parts of its range, there do not appear to be documented occurrences above the treeline in Region 2. This species could be affected by skier- and snowcat-compacted terrain. While portions of the project area occur in the life zone and at elevations inhabited by this species, this species, and indicator species for it were not located during plant surveys and it is considered to be absent in the project area.

Species of Local Concern

The 2002 Forest Plan does not include any standards or guidelines for the management of plant Species of Local Concern (SOLC). However, direction for the management of these species is provided in the Forest Service Manual (FSM) 2670.22, which states “Maintain viable populations of all native and desired nonnative wildlife, fish, and plant species in habitats distributed throughout their geographic range on National Forest System lands.”¹⁹²

SOLC detected on, and adjacent to, disturbance areas are based on systematic surveys conducted July 13 to 28, 2011. Table 3G-3 includes SOLC habitat and plants that were identified within the project area. A full list of WRNF SOLC that may occur in the project area are identified in the BE.

Table 3G-3:
White River National Forest Plant Species of Local Concern That May Occur in the Project Area

NRCS Plant Code	<i>Scientific Name</i>	Common Name	Habitat Present	Plant Found in Project Area
BOCR	<i>Botrychium crenulatum</i>	scalloped moonwort	Yes	No
BOEC	<i>Botrychium echo</i>	reflected grapefern	Yes	Yes
BOHE5	<i>Botrychium hesperium</i>	western moonwort	Yes	No
BOLAL	<i>Botrychium lanceolatum</i> var. <i>lanceolatum</i>	lanceleaf moonwort	Yes	No
BOLA	<i>Botrychium lanceolatum</i> var. <i>viride</i>	lanceleaf moonwort	Yes	No
BOLU	<i>Botrychium lunaria</i> b	common moonwort	Yes	Yes
BOMI	<i>Botrychium minganense</i>	Mingan moonwort	Yes	Yes
BOPA12	<i>Botrychium pallidum</i>	pale moonwort	Yes	No
BOPI	<i>Botrychium pinnatum</i>	northern moonwort	Yes	No
BOSI	<i>Botrychium simplex</i>	little moonwort	Yes	No
CRST2	<i>Cryptogramma stelleri</i>	fragile rockbrake	Yes	No
CYPL	<i>Cymopterus planosus</i>	Rocky Mountain spring parsley	No	No
CYFA	<i>Cypripedium fasciculatum</i>	clustered lady's slipper	Yes	Yes
DEAL	<i>Delphinium ramosum</i> var. <i>alpestre</i>	Colorado larkspur	Yes	No
LIKI2	<i>Linum kingii</i>	King's flax	Yes	No
LIBO4	<i>Listera borealis</i>	northern twayblade	Yes	No

¹⁹² Thompson, 2011

Table 3G-3:
White River National Forest Plant Species of Local Concern That May Occur in the Project Area

NRCS Plant Code	<i>Scientific Name</i>	Common Name	Habitat Present	Plant Found in Project Area
LYAN2	<i>Lycopodium annotinum</i>	stiff clubmoss	Yes	No
PIUN3	<i>Piperia unalascensis c</i>	Alaskan piperia	Yes	Yes

Source: R. McNeil, USFS East Zone Botanist, July 11, 2011, pers. comm.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

Alternative 1 reflects a continuation of existing operations and management practices at Beaver Creek without major changes, additions, or upgrades on NFS land.

Alternative 1 would have no additional direct or indirect impacts or benefits to the plants and habitats addressed in this document. Furthermore, Alternative 1 would have no direct or indirect impacts on any federally listed, R2 sensitive plant, or SOLC species. The condition of noxious weeds in the SUP area would also remain unchanged under Alternative 1.

Alternative 2 – The Proposed Action

Alternative 2 would result in permanent and short- to long-term disturbances (i.e., before reclamation of restored areas to pre-disturbance conditions) to 52.3 acres of habitat within Beaver Creek's SUP area.¹⁹³ Most impacts (31.8 acres, or 61 percent of the project area) would be to existing, graded ski trails and existing roads for snowmaking pipeline and other buried infrastructure installation, with disturbance areas returned to pre-disturbance uses. Virtually all of the remaining impacts would involve forest clearing for conventional ski trail development. Alternative 2 would affect a small proportion (less than 2 percent) of all vegetative communities within the SUP area, with the exception of barren areas (which include existing roads).

¹⁹³ Of the 52.3 acres of disturbances that would occur under Alternative 2, 50.6 and 1.7 (GRA and NBA) acres would occur on NFS and private lands, respectively. Because of the relatively small proportion of impacts to vegetation communities on private lands, they are not separated out from overall impacts hereinafter.

**Table 3G-4:
Alternative 2 Impacts to Vegetation Communities**

Vegetation community	Alternative 1 Acres (%)	Alternative 2 Acres (% of Veg. Comm.) Impacted
Barren (NBA)	12.2 (0.3)	4.6 (37.4)
Forblands (FOR, almost entirely ski trails)	1,155.1 (30.9)	3.2 (0.3)
Grassland (GRA, all ski trails)	0	23.97 (2.1 c,f)
Spruce-fir (TSF)	896.1 (24.0)	11.65 (1.3)
Lodgepole Pine (TLP)	815.7 (21.8)	1.15 (0.1)
Mixed Conifer (TMC)	0	6.25 (0.003 d,f)
Aspen (TAA)	784.1 (21.0)	1.22 (0.2)
Douglas-fir (TDF)	8.3 (0.2)	0 (0)
Blue spruce (TBS)	28.64 (0.8)	0.08 (0.3)
Alder (SAL)	0	0.17 (e,f)
Cottonwood (TCW)	8.6 (0.2)	0 (0)
Willows (SWI)	11.3 (0.3)	0 (0)
Sagebrush (SSA)	2.9 (0.1)	0 (0)
True mountain mahogany (SMS)	12.9 (0.3)	0 (0)
Total	3,736 (100)	52.28 (1.4)

Notes:

^a Source: USFS 2011, SE Group, and Western Ecosystems, Inc. Not field verified. Other than utilities improvements on the private inholding on the Western Hillside, numbers reflect the acreage of impacts to vegetation types on NFS lands within the SUP area that are part of BCR.

^b Field verified by Western Ecosystems, Inc.

^c Impact assessment based on using existing forbland acreage as the denominator.

^d Impact assessment based on using existing spruce-fir and lodgepole acreages as the denominator.

^e Division by zero.

^f Although the Forest Service database does not show grassland, mixed conifer or alder vegetation types within the project area, field verification confirmed the presence of 23.97 acres, 6.25 acres, and 0.17 acre of these habitats within proposed impact areas, respectively.

To minimize potential resource impacts resulting from implementation of the Beaver Creek Mountain Improvements project, Project Design Features (PDF have been incorporated into Alternative 2 (refer to Table 2-1 for specifics). Project Design Features were designed by the Forest Service and specialists involved in this analysis. The potential effects of implementing Alternative 2 were analyzed with these required PDF applied.

Noxious Weeds

In order to minimize the chances of spreading noxious weeds found in the project area, Project Design Features and Best Management Practices for vegetation would be followed (refer to Table 2-1).

Threatened and Endangered Plant Species

Botanical surveys were conducted through proposed disturbance areas in summer 2011. The one threatened plant with potential to be present in the project area—Penland alpine fen mustard (*Eutrema*

penlandii)—and its potential habitat were not located during four systematic plant surveys conducted throughout all potential disturbance areas. Suitable habitat for this species is not considered to be present on the project area and Alternative 2 would have “no effect” on this species.

Region Two Sensitive Plant Species

While five R2 sensitive plant species had potentially suitable habitat in the project area, Alternative 2 would not have any significant direct impacts on any R2 sensitive plant species. Alternative 2 would be consistent with all applicable Forest Plan standards and guidelines related to plants. As summarized in Table 3G-5 and detailed below, Alternative 2 would have no indirect impacts on any R2 sensitive plant species.

**Table 3G-5:
R2 Sensitive Plant Species In the Project Area**

Common name, <i>Scientific name</i>	Determination	
	Alternative 1	Alternative 2
Slender moonwort, <i>Botrychium lineare</i>	NI	MAII
Trianglelobe moonwort, <i>Botrychium ascendens</i>	NI	MAII
Paradox moonwort, <i>Botrychium paradoxum</i>	NI	MAII
Yellow lady’s slipper, <i>Cypripedium parviflorum</i>	NI	NI
Dwarf raspberry, <i>Rubus arcticus ssp. acaulis</i>	NI	NI

NI = No impact.

MAII = may impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing.

Determinations in this table only consider NFS lands that may be directly, indirectly, or cumulatively affected by the Proposed Action, which R2 species determinations are based on.

Slender Moonwort

While botanical surveys of the project area conducted at a time of year when slender moonwort would have been most detectable did not locate this species, other moonworts and suitable, but unoccupied moonwort habitat, and/or habitat where moonworts are not expressed above the ground, were located. It is possible, though extremely unlikely, that slender moonwort spores are present, but that the plants have not emerged. Therefore, with respect to slender moonwort, direct and indirect effects of Alternative 2, including the implementation of PDF and effects associated with other reasonably foreseeable projects considered in this analysis may impact individuals, but are not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing.

Trianglelobe Moonwort

Trianglelobe moonwort was not detected during plant surveys of the project area, however, portions of the project area support some of the ruderal habitats that this species is generally associated with. With respect to trianglelobe moonwort, the direct and indirect effects of Alternative 2 are that it may impact

individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing.

Paradox Moonwort

Paradox moonwort was not detected during plant surveys of the project area, however, portions of the project area support some of the ruderal habitats that this species is generally associated with. With respect to paradox moonwort, the direct and indirect effects of Alternative 2 are that it may impact individuals, but is not likely to result in a loss of viability on the planning area, nor cause a trend to federal listing.

Yellow Lady's Slipper

Habitat falling within the general continuum of this species is present within the project area, but the species was not located and is considered to be absent in the project area. Alternative 2 would have no direct or indirect effects on this species.

Dwarf Raspberry

While portions of the project area occur in the life zone and at elevations inhabited by this species, this species, and indicator species for it were not located during plant surveys and it is considered to be absent in the project area. Alternative 2 would have no direct or indirect effects on this species.

Species of Local Concern

While unavoidable disturbance of any of the species of local concern would not present a viability concern range-wide, disturbance of the Alaskan piperia population found near the proposed water tank site may present a viability concern forest-wide because it is the only known population in the WRNF. Refer to the following paragraphs for specific consideration of the environmental consequences related to SOLC.

Moonwort Species

Direct, indirect, and cumulative effects of the Proposed Action on moonwort SOLC present in the project disturbance areas would have the same effects as those described above for R2 sensitive moonworts. While considered sensitive, all three SOLC moonwort species are quite common on the WRNF. Therefore, in the event that some or all of the two moonwort populations in proposed disturbance areas at Beaver Creek would not be avoided, the loss of these individuals and populations would not present a viability concern Forest-wide or range-wide.

Clustered Lady Slipper

In the event that some or all of the clustered lady slipper populations would not be avoided, the loss of these individuals and populations would not present a viability concern Forest-wide or range-wide.

Alaskan Piperia

It is unlikely that plants composing the newly discovered Alaskan piperia population could be safely transplanted to adjacent, apparently suitable habitat without appreciable mortality risk. In the event that this *Piperia unalascensis* population would not be avoided, the loss of these individuals and populations would present a viability concern Forest-wide, but not range-wide.

CUMULATIVE EFFECTS

Appendix A includes a list of past, present, and reasonably foreseeable future projects have been identified by the Forest Service as relevant from a cumulative effects context.

Spatial and Temporal Extent of Analysis

The temporal extent of the analysis commences with conditions existing before the development of Beaver Creek in 1979, extend through the history of the resort to the present, and includes the lifespan of current proposed projects as well as those that are current reasonably foreseeable future actions, in general 10 to 20 years into the future from the date of this document.

Past Beaver Creek Resort Projects

The Beaver Creek improvement projects would only have potential direct or indirect impacts on slender, trianglelobe or paradox moonwort species and Alaskan piperia and therefore cumulative impacts to those species are considered. Beaver Creek contains some ski trails that support suitable moonwort habitat. Some of that potential moonwort habitat is sparsely and locally occupied by a low diversity of non-R2 moonwort species. Beaver Creek is a relatively young ski area, and it may support moonwort abundance and diversities common on other older ski area in the future. Conversely, Beaver Creek's ski trails have virtually all been developed by grading (as opposed to flush-cutting) resulting in coarser soils that are less favorable to some moonwort species. Furthermore, ski trails in the project area are xeric (also less favorable to some moonworts) and many are dominated by dense, smooth brome patches with a dense thatch layer where moonworts are rarely found.¹⁹⁴

When considered with past, present and reasonably foreseeable future projects, activities within the Beaver Creek SUP area has altered sensitive plant habitat. While some ski trails would continue to support suitable moonwort habitat within the SUP area, some ski trails have been, and would continue to be affected by grading or moisture and thus less favorable to some moonwort species. Cumulatively, the effects of Alternatives 1 or 2 are not anticipated to contribute to any change in status or viability for slender, trianglelobe or paradox moonwort species.

There has never been a population of Alaskan piperia identified within the SUP area. It is unknown how local populations of these species might interact throughout their range and therefore, how previous

¹⁹⁴ Thompson, 2003c

development within the SUP has affected this species. However, if this population is not able to be avoided, cumulative effects to this species from Alternatives 1 or 2 may present a viability concern Forest-wide.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Tree removal related to the Birds of Prey Women's Downhill Course, the Birds of Prey Men's Downhill Course, the women's Giant Slalom course on Grouse Mountain, the spectator access trail, the Red Tail Camp area, and the proposed water tank site would represent an irretrievable effect to vegetation resources within the SUP area. However, this is not considered an irreversible commitment because vegetation is a renewable resource and these areas could be restored over time.

H. SOIL RESOURCES

SCOPE OF THE ANALYSIS

The scope of the soils resource analysis includes areas proposed for direct disturbance in the Beaver Creek watershed on NFS lands within the SUP boundary. This analysis is based on review of the Holy Cross Area soil survey, field surveys completed July 19 and September 8, 2011 and post field work characterization of soil properties completed during the fall of 2011. Sample sites were selected to conduct a baseline survey of soil organic matter (organic *O* and mineral *A* horizons, commonly referred to as “duff” and “topsoil” layers, respectively) within proposed disturbance areas to ensure activities such as grading and clearing do not result in a net loss of soil organic matter or increased landscape instability.

FOREST PLAN DIRECTION

The 2002 Forest Plan, as amended, provides soil standards and guidelines to manage land treatments within the WRNF. The following guideline applies to the proposed projects at Beaver Creek:

Soil Guideline # 1 – Conduct an onsite slope stability exam in areas identified as potentially unstable. Potentially unstable land is described as having a “high” or “very high” [“high” or “severe” on WRNF GIS stability model] ranking. Limit intensive ground-disturbing activities on unstable slopes identified during examinations.¹⁹⁵

Additionally, pursuant to the 2002 Forest Plan, watershed management measures and design criteria are provided in the Region 2 Watershed Conservation Practices Handbook (WCPH). The WCPH contains two Management Measures (MM) and Project Design Criteria (PDC) regarding management of soils resources that apply to the proposed projects:

Management Measure # 2 (11.2.) – Manage land treatments to maintain enough organic ground cover in each activity area to prevent harmful increased runoff.

1. Design Criteria

- a. Maintain the organic ground cover of each activity area so that pedestals, rills, and surface runoff from the activity area are not increased. The amount of organic ground cover needed will vary by different ecological types and should be commensurate with the potential of the site.¹⁹⁶

Management Measure # 14 (14.2) – Maintain or improve long-term levels of organic matter and nutrients on all lands.

1. Design Criteria

- a. Consider need for retention of coarse woody debris slash in each activity area to balance soil quality requirements and fuel loading concerns.

¹⁹⁵ USDA Forest Service, 2002

¹⁹⁶ Such ground cover allows for prescribed fire and site preparation without increasing surface runoff from a 10-year storm (WRENSS II.60; USFS, 1966).

AFFECTED ENVIRONMENT

A total of 21 soil map units were identified within the SUP boundary.

**Table 3H-1:
Soil Management Units Identified within the SUP Boundary**

Soil Management Unit	Area (acres)
104A Cryoborolls-Cryaquolls association, 0–15% slopes	61.51
203C Handran family, till substratum, 4–60% slopes	19.98
212B Scout family, till substratum, 5–40% slopes	40.04
212C Scout family, till substratum, 40–60% slopes	158.33
225B Leighcan family-Cryaquolls complex, 0–25% slopes	51.50
226B Leadville family-Cryaquolls complex, 0–25% slopes	0.93
285D Scout-family-Rock outcrop-Hechtman family complex, 4–150% slopes	47.26
295D Rock outcrop-Scout-Hechtman families complex, 40–150% slopes	118.83
336B Gateview-Handran-Duffymont families complex, 0–25% slopes	29.73
346B Gateview-Handran families complex, 5–40% slopes	135.07
346C Gateview-Handran-Eyre families complex, 40–65% slopes	463.51
351C Scout family, 40–65% slopes	1,218.76
365B Scout-Handran families complex, 5–40% slopes	599.35
367B Scout-Leadville families complex, 5–40% slopes	197.58
376C Callings family, 40–60% slopes	0.34
395D Scout family-Rock outcrop-Cryoborolls complex, dry, 40–150% slopes	11.26
420C Subwell-Duffymont families complex, 40–65% slopes	35.62
446C Handran-Eyre families complex, 40–65% slopes	83.21
452B Anvik-Skylick-Handran families complex, 5–40% slopes	177.92
467B Leadville family, sandstone substratum, 5–40% slopes	380.97
4-RL Rubble Lands	11.82
AG11 Anvik-Skylick-Sligting association, 25–50% slopes	2.02
UNCL	3.51
W	0.13
GRAND TOTAL	3,849.16

Soils identified within the project area boundary can be grouped into 15 soil taxonomic units, plus miscellaneous land types including rubble land, unclassified land, and standing water. Drainage class ratings for these soils range from very poorly to somewhat excessively drained, and have variable runoff potential (slow to rapid). Generally, revegetation limitations are moderate within the project area due to low available water capacity and low inherent fertility. Slope revegetation limitations range from slight to severe due to slope, erosion hazards, and shallow depth to bedrock. Cut/fill slope stability potential varies

widely from slight to severe due to high water table, saturated soil, and/or cliff and rock outcrop exposures. Mass movement potentials of soils within the project area range from low to moderate.

Surface and subsurface soil erodibility is low to moderate within the project areas, with K-factor (K_w) values of surface soil horizons ranging from 0.08 to 0.24. Higher erosion risk ratings owe to coarse textures, high infiltration rates, and significant runoff potential.¹⁹⁷ Using the whole soil (w subscript) K-factor values best reflect natural soil conditions in the field as rock fragment serve to “armor” soil and make them less erodible overall.¹⁹⁸ Soil organic matter can also be related to soil erodibility as organic horizons allow infiltration and provide productive soils for stabilizing vegetation.¹⁹⁹ Maintenance of soil organic matter and surface O and A horizon integrity minimizes erosion, compaction, and hydrology problems within the ski area. Field surveys revealed no pedestals, rills or other signs of major soil erosion. Lacking common signs of surface erosion suggests that the relatively deep organic/mineral horizons and porous B and C horizons allow for sufficient infiltration during snowmelt runoff and summer rain events.

The depth of soil organic matter within the project area varies from 0 to 6 cm within the O horizon and 0 to 70 cm within the A horizon, with mean thickness of these materials of 3.9 cm and 30 cm, respectively. Samples within tree islands (which have not been previously disturbed) had a mean depth of 3.9 cm of O horizon material, whereas none of the samples from previously graded areas had an O horizon. Conversely, previously disturbed soils had a mean depth of 32 cm of “topsoil” (A horizon material), whereas undisturbed samples had a 23.5 cm depth of A horizon. Samples that revealed the greatest depth of A-horizon materials are located in the Red Tail Camp area, an area of low relief at the bottom of several graded ski trails. The deeper A horizons in disturbed soils as compared to undisturbed soils is likely attributable to migration of topsoil from ski trails uphill to the flatter Red Tail Camp area. For additional soil characteristics, refer to soils technical report contained in the Project File.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

No new development projects would not occur as a result of implementation of the No Action Alternative. The resort would continue to operate under its current configuration and capacity. Because no ground disturbance is proposed under the No Action Alternative, there is no potential to affect soil resources within the area of potential effect as a result of the No Action Alternative.

¹⁹⁷The factor K represents the soil’s susceptibility to erosion in their plot condition based on soil texture. Soils that are resistant to erosion have low K values (0.02 to 0.15); soils that display moderate erosion potential are in the middle of the range (0.16 to 0.27); and highly erodible soils tend to have values greater than 0.28. National Resource Conservation Service, 2008

¹⁹⁸ McCormick et al., 1982

¹⁹⁹ Franzluebbers, 2002; McMullen, 2011

Alternative 2 – Proposed Action

Implementation of the Proposed Action would result in approximately 30 acres of grading and approximately 22 acres tree removal and tree removal (areas where only grading would occur have been previously graded). All of the proposed projects occur within soils with low landslide potential. Use of the WRNF Landscape Stability Model predicted no areas of “Severe” or “High” risk within the areas of proposed soil disturbance; details of the modeled results are contained in the project file.

In previously graded areas, soil pits revealed a mean depth of 3.9 cm of O horizon and 30 cm of A horizon materials. Project disturbance that requires grading and tree removal occur in areas that have not been previously disturbed. Soil pits in these native areas had a mean depth of 3.9 cm of O horizon, whereas previously disturbed areas had no O horizon. After construction, re-spreading of stockpiled topsoil/A horizon material and/or the duff layer (O horizon) would promote the successful rehabilitation of these areas in addition to promoting compliance with USFS policy direction towards soil productivity.

There would be a permanent loss of 0.5 acre of soil resources where the new restaurant is installed. Since this area has previously been graded, soil compaction, reduction in organic matter and reduced vegetative cover has already occurred in this area. The 0.5-acre footprint for the restaurant would increase the impermeable acreage within the Beaver Creek watershed but, with removal of the existing Red Tail Camp restaurant the increase in impermeability would be minimized.

**Table 3H-2:
Ground Disturbance by Watershed**

Soil Management Unit	Kw	Area (acres)
UPPER BEAVER CREEK WATERSHED		
104A Cryoborolls-Cryaquolls association, 0–15% slopes	0.20	6.95
346C Gateview-Handran-Eyre families complex, 40–65% slopes	0.15	1.42
351C Scout family, 40–65% slopes	0.08	3.86
452B Anvik-Skylick-Handran families complex, 5–40% slopes	0.24	0.88
Private Land	--	1.76
WESTFALL CREEK WATERSHED		
104A Cryoborolls-Cryaquolls association, 0–15% slopes	0.20	2.77
212C Scout family, till substratum, 40–60% slopes	0.08	11.38
346C Gateview-Handran-Eyre families complex, 40–65% slopes	0.15	1.68
351C Scout family, 40–65% slopes	0.08	16.98
467B Leadville family, sandstone substratum, 5–40% slopes	0.24	4.61
GRAND TOTAL	0.08–0.24	52.3

Note: Kw – Surface and subsurface susceptibility of erosion for the whole soil.

Data collected from the inventory and characterization of soil organic matter quantities prior to implementation of the Proposed Action will serve as a baseline for the existing condition vis-à-vis soil organic matter. Upon completion of proposed projects, reassessments of the quantity (depths) of soil A and/or organic ground cover would be made to ensure no net loss of this material. If a net loss has occurred, the activity areas would be restored using soil organic amendments (i.e., composted wood chip blends, biochar, biosol) if deemed necessary and practical by USFS personnel. This would help offset the loss of soil organic matter by grading and clearing activities. Additionally, this would ensure compliance with policy direction such as “Maintain long-term levels of organic matter and nutrients on all lands.” If supplemental organic amendments are deemed necessary and practical, using woody biomass harvested from project area boundaries and processed on site would be preferable.²⁰⁰

CUMULATIVE EFFECTS

Appendix A includes a list of past, present, and reasonably foreseeable future projects have been identified by the Forest Service as relevant from a cumulative effects context.

Spatial and Temporal Extent of Analysis

The spatial extent of the cumulative effects analysis for soils is the Beaver Creek SUP area.

The temporal extent of the analysis commences with conditions before the development of Beaver Creek in 1980, extending through the history of the Resort to the present, and includes the lifespan of current proposed projects as well as those that are current reasonably foreseeable future actions, in general 5 to 10 years after implementation of the Proposed Action.

Past Beaver Creek Resort Projects

Development at Beaver Creek through vegetation removal, grading and installation of facilities has affected the soils resource, particularly the depth of organic-rich soil horizons, across the SUP area. Beaver Creek implements drainage management and erosion control such as water bars and revegetation (as required by the Forest Service). These management activities have generally been effective at stabilizing soils within the project area. However, some slumps were observed outside the project area, thereby indicating increased water management measures may be necessary. Cumulatively, if the disturbance required by the Proposed Action is carefully managed with effective erosion control, the low to moderate movement potential of the soil management units coupled with relatively deep organic matter and well-drained mineral subsoils would serve to prevent further impacts to the soils resource within the SUP. BMPs would include stockpiling topsoil and applying organic soil amendments to areas where soils disturbance occurs, where practical.

²⁰⁰ McMullen, 2011

Beaver Creek Forest Health Project and Vail/Beaver Creek Bug Tree Projects

Forest health and fuels projects have occurred or are occurring over a large area, approximately 82,000 acres of the 2,482,000 acres within the WRNF. Generally these projects require removal of stabilizing vegetation. However, with implementation of appropriate BMP and PDC to reduce overland flow and erosion and minimize removal or disturbance of the organic layer, cumulatively, overstory removal within Alternative 2 and tree salvage projects would have a minimal affect to soils resources.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Approximately 0.5 acre of soil resources would be replaced with a permanent structure (Red Tail Camp) under Alternatives 2. Soil is a very slowly renewable resource, as estimates for rates of soil formation range from .0056 cm to .00078 cm a year.²⁰¹ Globally, rates of soil formation are not keeping pace with erosion, leading to widespread soil loss that in part owes to grading activities such as those associated with ski area development.²⁰² In this sense, soil loss from development in the Red Tail Camp is an irreversible and irretrievable commitment of resources.

²⁰¹ Alexander, 2006

²⁰² Wakatsuki and Rasyidin, 1992

I. WATER RESOURCES

SCOPE OF THE ANALYSIS

The scope of the water resources analysis focuses on riparian and wetlands resources within the Westfall Creek and Upper Beaver Creek watersheds on NFS at Beaver Creek Resort. The surface area comprised by these watersheds totals approximately 6,903 acres.

FOREST PLAN DIRECTION

Pursuant to the 2002 Forest Plan, as amended, stream health management measures and design criteria are provided in the Region 2 Watershed Conservation Practices Handbook (WCPH) to ensure applicable Federal and State laws are met on NFS lands in Region 2.²⁰³ The WCPH contains several Management Measures of relevance regarding stream health and water resources effects:

Applicable WCPH Management Measures (MM)

The WCPH includes Management Measures that are environmental goals to protect soil, aquatic and riparian systems.²⁰⁴

- MM-1. Manage land treatments to conserve site moisture and to protect long-term stream health from damage by increased runoff.
- MM-2. Manage land treatments to maintain enough organic ground cover in each activity area to prevent harmful increased runoff.
- MM-3. In the water influence zone (WIZ) next to perennial and intermittent streams, lakes, and wetlands, allow only those actions that maintain or improve long-term stream health and riparian ecosystem condition.
- MM-4. Design and construct all stream crossings and other instream structures to provide for passage of flow and sediment, withstand expected flood flows, and allow free movement of resident aquatic life.
- MM-5. Conduct actions so that stream pattern, geometry, and habitats maintain or improve long-term stream health.
- MM-6. Maintain long-term ground cover, soil structure, water budgets, and flow patterns of wetlands to sustain their ecological function.
- MM-8. Manage water use facilities to prevent gully erosion of slopes and to prevent sediment and bank damage to streams.

²⁰³ USDA Forest Service, 2002a; USDA Forest Service, 2006

²⁰⁴ Id.

- MM-16. Apply runoff controls to disconnect new pollutant sources from surface and groundwater.

Management Area 8.25 – Forest Plan Standard

The Forest Plan Water and Aquatic Resource Standard included in Management Area 8.25 is listed below:

- Standard 3. Snow management, including snowmaking and snow farming, will be conducted in a manner that prevents slope failures and gully erosion, as well as bank erosion and sediment damage in receiving channels.

Relevant WCPH Definitions

FSH 2509.25 (The Watershed Conservation Practices Handbook) provides definitions for some terms that are important to conveying information in this report:

Concentrated-Use Site: Areas designed and managed for high density of people or livestock, such as developed recreation sites and livestock watering areas.

Ephemeral Stream: A stream that flows only in direct response to precipitation in the immediate locality (watershed or catchment basin), and whose channel is at all times above the zone of saturation.

Intermittent Stream: A stream or reach of stream channel that flows, in its natural conditions, only during certain times of the year or in several years. It is characterized by interspersed, permanent surface water areas containing aquatic flora and fauna adapted to the relatively harsh environmental conditions found in these types of environments.

Gully: An erosion channel greater than 1-foot deep.

Permanent Stream: A stream or reach of a channel that flows continuously or nearly so throughout the year and whose upper surface is generally lower than the top of the zone of saturation in the areas adjacent to the stream.²⁰⁵

Rill: An erosion channel less than 1-foot deep.

Swale: A landform feature lower in elevation than adjacent hillslopes, usually present in headwater areas of limited areal extent, generally without display of a defined watercourse or channel that may or may not flow water in response to snowmelt or rainfall. Swales exhibit little evidence of surface runoff and may be underlain by porous soils and bedrock that readily accepts infiltrating water.

Water Influence Zone: The land next to water bodies where vegetation plays a major role in sustaining long-term integrity of aquatic systems. It includes the geomorphic floodplain (valley

²⁰⁵ USDA Forest Service, 2006

bottom), riparian ecosystem, and inner gorge. Its minimum horizontal width (from top of each bank) is 100 feet or the mean height of mature dominant late-seral vegetation, whichever is most.

AFFECTED ENVIRONMENT

Project Area Description

Beaver Creek Resort is situated at elevations ranging from 8,100 and 11,400 feet, receiving most of its annual precipitation as snow during the winter months. Average annual precipitation ranges from 24 inches at the lower elevations to 27 inches at the higher elevations. Monthly mean temperatures during the winter months are between 16 and 26 degrees Fahrenheit; average temperatures for the summer months range between 50 and 57 degrees Fahrenheit.

Westfall Creek is a second-order stream tributary to Beaver Creek, which drains an area of approximately 1,070 acres in a south-to-north direction. Beaver Creek flows north from its headwaters near Mount Jackson to its confluence with the Eagle River. For purposes of this analysis, the Upper Beaver Creek is the third-order stream draining an area of 6,903 acres (including its tributary Westfall Creek watershed) from the basin's upper boundary above 13,000 feet down to 8,400 feet of elevation, just north of the project boundary. The study watersheds are depicted on Figure 3 Water Resources.

Water Yield

Runoff hydrographs for watersheds in the area of interest were developed following the methodologies included in WRENSS Model and in the Colorado Ski Country USA (CSCUSA) Report.²⁰⁶ In summary, the WRENSS Model generates a water balance using seasonal precipitation and vegetation type and density (distributed by watershed aspect). The Model then computes the amount of water potentially available for runoff. The water balance of the WRENNS Model is coupled with a snowmaking hydrology computation process developed through the CSCUSA study. Together, these calculations produce estimates of water yield typical of subalpine mountain watersheds. For each study watershed, the WRENSS Model distributes the calculated yield using simulated hydrographs based on hundreds of years of data recorded at several different gauging stations. The simulated hydrographs represent the normalized distributions of the annual yield in 6-day intervals throughout the year.

The WRENSS Model and snowmaking hydrology computations do not include routing of runoff water through the watershed to the stream system. In other words, the water yield hydrographs do not represent streamflow per se, but rather basin-wide water yield available to the receiving streams. However, once the surface layers of soil have been saturated, snowmelt runoff is efficiently routed through the watershed.²⁰⁷ Thus, in Rocky Mountain watersheds with distinct stream channels, such as Beaver Creek and Westfall

²⁰⁶ Ibid.

²⁰⁷ USDA Forest Service, 2002b

Creek, the modeled hydrographs may be conceptualized as streamflow, particularly during the rising limb of the hydrograph.

The hydrographs were modeled under baseline, existing, and proposed conditions using average precipitation and temperature data for each watershed. The purpose of this modeling effort is to estimate the effects of proposed ski area development and activities on the watersheds' yield and peak flow. The baseline hydrographs modeled conditions prior to any human impacts, such as ski trail development, took place in these watersheds. Under existing conditions, water yields for these watersheds are affected by the existing ski trail system and the input of additional water in the form of snowmaking. Table 3I-1 summarizes the forested and cleared areas corresponding to the existing conditions. Table 3I-2 displays the existing snowmaking coverage and associated water usage by watershed.

Table 3I-1:
Beaver Creek Resort's Watersheds – Existing Conditions

Watershed	Surface Area (acres)				
	Total	Above Treeline	Forested	Glades	Cleared
Westfall Creek	1,072	171	667	13	221
Upper Beaver Creek ^a	6,903	1,140	4,856	379	528

^a Includes acreage of tributary Westfall Creek watershed.

Table 3I-2:
Snowmaking Coverage on Beaver Creek Resort's Watersheds – Existing Conditions

Watershed	Ski Trail (acres)	Snowmaking Coverage (acres)	Snowmaking Water Used (AF)
Westfall Creek	221	106	96
Upper Beaver Creek ^a	528	179	162

^a Includes acreage of tributary Westfall Creek watershed.

Average-year water yields and peak flows calculated using the WRENNS Model for each watershed are summarized in Table 3I-3, for both baseline and current conditions. Hydrograph plots that depict the distribution of these water yields in time were also developed using the WRENNS Model. These hydrographs reveal flow characteristics reflective of the current ski trail system and snowmaking applications. In general, watersheds influenced by vegetative clearing and snowmaking produce hydrographs with peak flows that are higher and occur earlier during the snowmelt season as compared to pre-development conditions. This is a result of the higher volume and rate of snowmelt due to increased solar radiation in cleared areas and also due to the snowmaking water input (additional to natural precipitation) to the affected watersheds.

**Table 3I-3:
WRENNS Model Output for Baseline & Existing Conditions – Average Year**

Watershed	Baseline Conditions		Existing Conditions	
	Water Yield (AF)	Peak Flow (cfs)	Water Yield (AF)	Peak Flow (cfs)
Westfall Creek	1,026	10	1,185	12
Upper Beaver Creek	6,803 ^a	63 ^a	7,127 ^a	67 ^a

^a Yield and peak flow calculated for Upper Beaver Creek include effects of tributary Westfall Creek.

It is important to emphasize that Table 3I-3 depicts the modeled yield and peak flow values corresponding to average precipitation for the study watersheds. The watershed yield and peak flow can differ significantly from year to year due to natural variability of precipitation patterns. For example, a typical wet year, such as 1995, with annual precipitation about 30 percent higher than the average year for the Upper Beaver Creek watershed produced an estimated yield and peak flow 67 percent higher than those corresponding to the average precipitation year. Similarly, a typical dry year, such as 1977, with annual precipitation equal to 70 percent of the average generated a watershed yield and peak flow approximately 40 percent of the average year amounts. The modeled results for the typical dry and wet years are shown in Table 3I-4.

**Table 3I-4:
WRENNS Model Output for Existing Conditions – Dry, Average, and Wet Years**

Watershed	Dry Year		Average Year		Wet Year	
	Water Yield (AF)	Peak Flow (cfs)	Water Yield (AF)	Peak Flow (cfs)	Water Yield (AF)	Peak Flow (cfs)
Westfall Creek	521	6	1,188	12	1,916	19
Upper Beaver Creek	2,873 ^a	29 ^a	7,127 ^a	67 ^a	11,886 ^a	112 ^a

^a Yield and peak flow calculated for Upper Beaver Creek include effects of tributary Westfall Creek.

Stream Health

Stream Health Definitions

As described above, the Forest Plan adopted the WCPH for direction on projects that affect water resources. The WCPH mandates several Management Measures of relevance regarding stream health and water resources effects. To facilitate the evaluation of stream health compliance in the context of the WCPH Management Measures, the WCPH outlines several key definitions relevant to the quantification of stream health.

Stream Health: The condition of a stream versus reference conditions for the stream type and geology, using metrics such as channel geometry, large woody debris, substrate, bank stability, flow regime, water chemistry, and/or aquatic biota.

Stream Health Class: A category of stream health. Three classes are recognized in the Rocky Mountain Region: Robust, At-Risk, and Diminished (refer to Table 3I-5). These classes are recommended to be used for assessing long-term stream health and impacts from management activities.

Table 3I-5:
Stream Health Classes for Attainment of Forest Plan Standards (WCPH)

Stream Health Class	Habitat Condition
Robust	Stream exhibits high geomorphic, hydrologic and/or biotic integrity relative to its natural potentials condition. Physical, chemical and/or biologic conditions suggests that State assigned water quality (beneficial, designated or classified) uses are supported.
At-Risk	Stream exhibits moderate geomorphic, hydrologic and/or biotic integrity relative to its natural potential condition (as represented by a suitable reference condition). Physical, chemical and/or biologic conditions suggest that State assigned water quality (beneficial, designated or classified) uses are at risk and may be threatened.
Diminished	Stream exhibits low geomorphic, hydrologic and/or biotic integrity relative to its natural potential conditions (as represented by a suitable reference condition). Physical, chemical and/or biologic conditions suggest that State assigned water quality (beneficial, designated or classified) uses may not be supported.

Existing Stream Health

Stream health classes are used for assessing long-term stream health and impacts from management activities. Several WCPH management measures make reference to stream health and MM-3 specifically states that “only those actions that maintain or improve long-term stream health and riparian ecosystem condition” would be allowed in the WIZ.

Stream health was considered for two reaches in the project area. The first was for Beaver Creek below the confluence with Westfall Creek, the second was for Westfall Creek proper. Beaver Creek, in the vicinity of the project area, is a step-pool channel with an average gradient of about 7 percent. The substrate is dominated by boulders and cobbles, which form stable steps throughout the longitudinal profile. Physical habitat survey data from 2011 show very stable banks (1.1 percent unstable), well developed and frequent pools (1 foot average residual pool depth) and less than 10 percent fine sediment on the bed.

Since the WCPH stream health management measures apply to minimum third order watersheds, no formal stream health survey was conducted for Westfall Creek, which is a 2nd order watershed. Field observations show that Westfall Creek stream channel is rocky, stable and generally steep with an average slope of 22 percent. The channel structure is controlled by cobble and boulder-sized material and very little stream bank instability was observed during site visits in 2011. Even in the absence of formal stream health data, Westfall Creek is managed under the same 'maintain or improve' language as larger streams that are subject to the WCPH stream health management measures. This means that proposed disturbances in the watershed need to be offset by improvements to insure that water quality and habitat conditions are not degraded by proposed activities.

Disturbance of the WIZ has a direct impact in stream health metrics, such as channel sedimentation and wood frequency. The WCPH states the importance of the WIZ in the protection of interacting aquatic, riparian, and upland functions.²⁰⁸ Furthermore, Management Measure MM-3 includes design criteria requiring that new concentrated-use sites be located outside the WIZ if practicable. Tables 3I-6 and 3I-7 summarize the existing impacts to the study watersheds.

Table 3I-6:
Impacts to the Forested Areas within Beaver Creek Resort's Watersheds – Existing Conditions

Watershed	Baseline Forested (acres)	Existing Forested (acres)	Percent Reduction (%)
Westfall Creek	887	674	24
Upper Beaver Creek	5,371 ^a	4,843 ^a	10 ^a

^a Includes acreage of tributary Westfall Creek watershed.

Table 3I-7:
Impacts to the WIZ within Beaver Creek Resort's Watersheds – Existing Conditions

Watershed	Baseline Forested WIZ (acres)	Existing Forested WIZ (acres)	Impacted WIZ (%)
Westfall Creek	91	74	19
Upper Beaver Creek	569 ^a	512 ^a	10 ^a

^a Includes acreage of tributary Westfall Creek watershed.

Existing Connected Disturbed Area

To help further define existing conditions related to stream health, a field investigation was completed during the summer of 2011. The investigation focused on the ski trails and forested areas that would be developed or improved if the Proposed Action is implemented (e.g., *Peregrine*, *Birds of Prey*, *Raven Ridge*, *Golden Eagle*, *Lower Larkspur*, and *Paint Brush*). Specifically, the goal of the field investigation was to provide insight as to the extent to which the disturbed road surfaces and ski trails route surface flows directly to the stream system (i.e., are connected to the stream) within each watershed.

Field observations in the study area indicate that a vast majority of the snowmelt runoff rapidly infiltrates into the ground. For example, typical indications of active surface runoff, such as rilling and sediment deposition, were seldom observed within roadside ditches and waterbars. In addition, no indication of surface runoff was observed on the ski trails, particularly above 9,300 feet in elevation. Soils in these upper and middle sections of the investigated ski trails have a cobbly loam/gravelly loam composition with moderate to moderately rapid permeability.²⁰⁹ The vegetation existing on these trails above 9,300 feet was observed to be mostly weeds and moss.

²⁰⁸ Reid and Ziemer, 1994

²⁰⁹ USDA Forest Service, 1995

The hill slope below 9,100 feet of elevation becomes less steep and is well vegetated with mountain grasses and shrubs. Water bars in the lower sections of the ski trails convey surface runoff and discharge into well forested areas. A few springs were observed in these lower elevations. For example, flow from one spring just above the Red Tail Camp area is collected by a water bar and discharged into a stream channel tributary to Westfall Creek. Additional springs in the Larkspur/Paint Brush area are conveyed by natural drainage channels and discharged into Beaver Creek. In summary, direct hydrologic connection from disturbed areas into the channel network was seldom observed in the study area. The conclusion of the field investigation is that most ski trails in the study area are disconnected from the stream system.

Data collected during the field investigation was incorporated into a Geographic Information System (GIS) database in order to estimate the spatial extent of CDAs. Ski trails and roads where clear evidence of direct hydrologic connection to the stream system was observed were classified as CDAs. In addition, ski trails and roads within a 100-foot stream buffer were conservatively assumed to be connected to the stream channel network, unless field observations proved otherwise. The calculated surface of the CDAs totals 20 acres or approximately 4 percent of the ski trails within the study watersheds. Similarly, the estimated length of roads connected to the stream system totals 10,366 feet or about 9 percent of the natural stream channel network length. Results from the investigation are displayed in Tables 3I-8 and 3I-9.

Table 3I-8:
Connected Roads within Beaver Creek Resort's Study Watersheds – Existing Conditions

Watershed	Natural Stream Channel Length^a (ft)	Road Drainage Connected Length^a (ft)	Percent Increase of Channel Length (%)
Westfall Creek	14,710	661	5
Upper Beaver Creek	112,004 ^b	6,537 ^b	6 ^b

^a Derived from GIS and field-collected data analysis

^b Includes impacts to Westfall Creek

Table 3I-9:
CDA within Beaver Creek Resort's Study Watersheds – Existing Conditions

Watershed	Existing Ski Trails and Roads (acres)	Connected Disturbed Areas^a (acres)	Percent Ski Trails that are Connected (%)
Westfall Creek	204	4.5	2
Upper Beaver Creek	528 ^b	17.5 ^b	4 ^b

^a Derived from GIS and field-collected data analysis

^b Includes Westfall Creek connected disturbed areas

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

Under the No Action Alternative, Beaver Creek Resort would continue current summer and winter seasonal operations, which include the only men's World Cup event in the United States. Improvement and expansion of existing skiing terrain would not occur as a result of this alternative. The Red Tail Camp facility would continue to provide guest services at the current 475-seat total capacity (indoor and outdoor). This alternative would have no additional direct or indirect effects on the watershed and aquatic resources.

Alternative 2 – Proposed Action

Alternative 2 includes widening existing ski trails; constructing new trail segments; strategic trail grading projects; installing new snowmaking infrastructure; relocating and upgrading existing utilities (such as water, sewer, electrical, gas, phone, and fiber optic); and construction of a new 150,000 gallon water tank and associated water line (2,900 feet long). These improvements would be implemented over a total of 52 acres distributed throughout the study area. Of this total, 30 acres (58 percent) correspond to currently graded areas such as existing roads, existing ski trails, and the current Red Tail Camp area. Additionally, vegetation clearing and grading would occur on approximately 22 acres of currently undisturbed areas. Most of this disturbance (20 acres) would occur within the Westfall Creek watershed. The proposed clearing represents 3 percent and 0.5 percent of the existing forested areas within Westfall Creek and Upper Beaver Creek, respectively. This would increase the corresponding forest clearings to 26 percent and 10 percent relative to baseline conditions. Table 3I-10 compares the proposed vegetation clearing against existing and baseline conditions.

In summary, the following additional impacts to the study watersheds are proposed under Alternative 2:

1. Vegetation clearing and terrain grading to improve existing Men's Birds of Prey Racecourse;
2. Vegetation clearing and terrain grading to construct the new Women's Downhill and Women's Giant Slalom racecourses;
3. Piping a 150-foot section of Westfall Creek to enhance racecourse finish area; and
4. Vegetation clearing and terrain grading to install new and upgrade existing water and waste water infrastructure.

These proposed impacts and mitigation measures are discussed in the following paragraphs.

**Table 3I-10:
Forest Clearing – Proposed Action**

Watershed	Baseline Forested Area (acres)	Existing Forested Area (acres)	Proposed Clear-Cut (acres)	Proposed Cumulative Clear-Cut (acres)
Westfall Creek	887	674	20	234 (27%)
Upper Beaver Creek	5,371 ^a	4,843 ^a	22 ^a	543 ^a (10%)

^a Includes Westfall Creek surface areas.

Alternative 2 proposes to re-configure the Red Tail Camp area in order to accommodate a larger finish area for the Alpine racing events and increase its seating capacity. The proposed reconfiguration would require piping a 150-foot section of Westfall Creek that runs through the Red Tail Camp area. This 150-foot long channel is located within the existing Red Tail Camp developed area, between 2 relatively long culverted sections of Westfall Creek. Although this 150-foot reach provides little value to the hydrologic function of the watershed, its impact would be mitigated. An existing Westfall Creek culvert located about 1,700 feet upstream of the Red Tail Camp area would be removed, restoring a 285-foot section of stream channel. Details of this mitigation project are outlined in detail in the Stream Health paragraphs, below.

Additionally, implementation of improvements to the women's downhill racecourse would impact a 225-foot section of a natural swale that conveys water during the runoff season. Water flows seasonally through this swale from a spring approximately 500 feet upstream of the proposed grading until it infiltrates into the ground. A field investigation in this area did not observe riparian vegetation along the swale. Under Alternative 2, the swale would be graded to widen the racecourse. A culvert would be designed and installed to adequately convey the spring water through the fill area. The culvert design would be review and approved by WRNF resource specialists prior to installation.

The Proposed Action would also include the expansion of the snowmaking infrastructure to cover 38 acres of existing and proposed trails. This would entail an increase in the annual snowmaking water demand to approximately 196 acre feet (AF) (approximately 34 AF or 21 percent relative to existing amounts), as displayed in Table 3I-11.

**Table 3I-11:
Snowmaking Coverage and Associated Water Demands**

Watershed	Snowmaking Coverage (acres)		Snowmaking Water (AF)	
	Existing	Proposed	Existing	Proposed
Westfall Creek	106	140	96	127
Upper Beaver Creek	179	217	162	196

^a Includes snowmaking within tributary Westfall Creek watershed.

Water Yield

Output of the WRENSS Model indicates that the 20 acres of forest clearing combined with the 31 AF of additional snowmaking water input would increase both water yield and peak flow in the Westfall Creek watershed by approximately 3 percent and 5 percent respectively.²¹⁰ However, the Model shows no significant change in the Upper Beaver Creek hydrograph between existing and proposed conditions despite the 22 acres of forest clearing and the additional snowmaking coverage in the Upper Beaver Creek watershed. This is due to the small impact that the Proposed Action would have on the Upper Beaver Creek watershed relative to existing conditions. The 22 acres of total tree removal proposed under Alternative 2 represent 0.5 percent of the 4,843 acres of existing forests within the Upper Beaver Creek watershed.

The modeled increases in yield and peak flow are relatively minor as compared to the natural variability of the study watersheds hydrology. As stated before in this report, during a typical wet year the study watersheds may produce an annual yield approximately 60 percent higher than the average. Also during a typical wet year, peak flows may increase more than 50 percent due to larger snowpacks. The reader is referred to Table 3I-4 detailed information on expected yields and peak flows during typical dry, average, and wet years.

Table 3I-12 and Table 3I-13 display a comparison in estimated average year peak flow and yield under baseline, existing, and proposed conditions.

Table 3I-12:
Estimated Increase in Annual Yield under the Proposed Action – Average Year Conditions

Watershed	Water Yield (AF)			Increase Relative to Existing Yield (%)	Cumulative Increase Relative to Baseline Yield (%)
	Baseline	Existing/ No Action	Proposed Action		
Westfall Creek	1,026	1,185	1,219	3	19
Upper Beaver Creek	6,803	7,127	7,162	0.5	5

^a Yields calculated for Upper Beaver Creek include effects of tributary Westfall Creek watershed.

²¹⁰ Troendle & Leaf, 1980

Table 3I-13:
Estimated Increase in Peak Flows under the Proposed Action – Average Year Conditions

Watershed	Peak Flow (cfs)			Increase Relative to Existing Peak Flow (%)	Cumulative Increase Relative to Baseline Peak Flow (%)
	Baseline	Existing/ No Action	Proposed Action		
Westfall Creek	9.6	12.2	12.7	5	32
Upper Beaver Creek	63	67	67	0	6

^a Peak flows calculated for Upper Beaver Creek include effects of tributary Westfall Creek watershed.

Potential Management Effects to Stream Health

The WRNF typically focuses on four physical metrics when evaluating channel survey data: bank stability, fine sediment, residual pool depth, and large woody debris. A description of each stream health metric and its causal mechanisms follow in the paragraphs below.

Metric:

Unstable Banks: A streambank showing evidence of the following: breakdown (clumps of bank are broken away and banks are exposed); slumping (banks have slipped down); tension cracking or fracture (a crack visible on the bank); or vertical and eroding (bank is mostly uncovered, less than 50 percent covered by perennial vegetation, roots, rocks of cobble size or larger, logs of 0.1 meter in diameter or larger, and the bank angle is steeper than 80 degrees from the horizontal).²¹¹ Undercut banks are considered stable unless tension fractures show on the ground surface at the back of the undercut.²¹²

Causal Mechanism(s):

Channel Network Extension: Roadside drainages frequently connect directly to the stream channel and result in a net increase in the length of the existing channel network within the watershed. This increases the efficiency of flow routing within the watershed, increasing peak flows and subsequent erosion and sediment transport. The WCPH outlines the following Design Criterion under MM-1: “In each 3rd order and larger watershed, limit connected disturbed areas so that the total stream network is not expanded by more than 10 percent. Progress toward zero connected disturbed area as much as feasible.” Roads usually are primary sources of channelized connection between disturbed soils and the stream channel. Because roadside drainage ditches provide an efficient mechanism for capturing runoff and frequently drain to a stream system, a direct link between the road-generated sediment source and the stream system is easily created. A second potential source of connected disturbance could be sparsely vegetated ski trails with drainage water bars that connect directly to the stream system.

Connected Disturbed Areas: In terms of the effect of proposed management activities upon bank stability conditions in affected stream reaches, ultimately the area of disturbance and/or snowmaking that is

²¹¹ Bauer and Burton, 1993

²¹² USDA Forest Service, 2006

directly connected to the stream system is the variable of management concern. The WCPH defines connected disturbed area (CDA) as follows: “High-runoff areas like roads and other disturbed sites that discharge surface runoff into a stream or lake.” Field observations during the spring runoff period at several ski areas in Colorado verified that instances where high surface flows emanating from graded ski trails and roads are then routed directly to the stream meet the WCPH definition of a connected disturbed area.

The WCPH clearly documents the relationship between CDA and effects to peak flows in the associated stream system. Likewise, the effect of channel network extension and the increased efficiency of hydraulic routing has been well-documented by several investigations, including references in the Zero Code of the WCPH.²¹³

Metric:

Channel Sedimentation (Percent Fines and Residual Pool Depth): The effects of land disturbances such as ski trail development and grading within forested watersheds tend to cause an increase in exposed and compacted surface soils and therefore increase erosion and sediment transport. An increase of sediment load input to the stream network of a watershed is often indicated by higher percentages of fine-grained particles on the channel bed. Fine sediment deposition can diminish habitat by aggradation, or filling in, of pool systems. Pools are important components of habitat for many fish species and other aquatic organisms. Filling by fines affects pool habitat by burying the natural substrate and reducing its volume, particularly during low flow conditions.

Causal Mechanism(s):

Connected Disturbed Area (CDA): High-runoff areas, like roads and other disturbed sites, having a continuous surface flow path into a stream or lake. Hydrologic connection exists where overland flow, sediment, or pollutants have a direct route to the channel network. CDAs include roads, ditches, compacted soils, bare soils, and areas of high burn severity that are connected to the channel system. Ground disturbing activities located within the water influence zone (WIZ) should be considered connected unless site-specific actions are taken to disconnect them from the streams. CDA provides a measure of the extent to which a stream reach is influenced by direct, channelized connections between disturbed soils and the stream network itself.

Metric:

Wood Frequency: Sustainable woody debris recruitment is recognized as an important riparian function in mountain channels. Standing dead trees provide habitat for nesting species in the riparian zone and contribute detritus and insects to streams. Once in streams, coarse woody debris helps maintaining channel structure by storing sediment and encouraging pool scour. Large woody debris (LWD) reduces

²¹³ Burroughs and King, 1989; Troendle and Olsen, 1994

stream energy by interrupting the continuous slope of channel beds and creating turbulence. In streams supporting fisheries, LWD also helps provide stable fish habitat by retaining spawning gravel and by serving as rearing cover.

Causal Mechanism(s):

Vegetation Removal in WIZ: Recruitment of LWD is dependent upon maintenance of riparian vegetation structure and function. Removal of vegetation within the WIZ has been demonstrated to have a negative impact upon maintenance of adequate wood frequency. In addition, culverts located along the stream channels often present an obstacle to LWD transport within the stream system. Because these culverts must be periodically cleared of obstructions caused by woody debris, they constitute sites of net woody debris loss from the stream system.

Stream Health

Alternative 2 would involve clearing existing forested areas within the Westfall Creek and Upper Beaver Creek watersheds. The Proposed Action was evaluated against the current stream health conditions for these two streams. As previously mentioned in this report, MM-3 included in the WCPH states that only those projects that maintain or improve long-term stream health should be allowed in the WIZ next to perennial and intermittent streams. In order to evaluate the potential additional CDAs resulting from the Proposed Action, the WIZ was delineated along the stream channels within the study watersheds using a 100-foot buffer. The WCPH considers ground disturbing activities within the WIZ as connected to the stream, unless site specific actions are implemented to disconnect these areas from the stream.

Design Criteria for MM-1 states that “In each watershed containing a 3rd-order and larger stream, limit connected disturbed areas so the total stream network is not expanded by more than 10 percent.” Direct connection of disturbances to the stream channel, such as roads via roadside ditches, results in a net increase in the length of the existing channel network within the watershed. Connected disturbed areas capture surface runoff and concentrate flows within the watershed, increasing both volume and peak streamflows. This, in turn, creates a direct link between the sediment generated in disturbed areas and the stream system. As discussed before, CDAs have a direct, negative impact in stream health metrics such as unstable banks and channel sedimentation.

Westfall Creek

New activities in the Westfall Creek watershed would require appropriate Project Design Features (PDF in order to “maintain or improve” stream health in accordance with WCPH Management Measures (MM) 1, 3, 5, and 8 along with Forest Plan Management Area 8.25 Standard 3.

Impacts to WIZ and Proposed CDA

The Proposed Action would clear 1.4 acres of vegetation within Westfall Creek’s WIZ (approximately 0.25 acre within the Red Tail Camp area and the remaining 1.15 acres for the proposed Women’s

Downhill course). This represents 2 percent of the approximate total of 74 acres of forested areas within Westfall Creek's WIZ. As discussed earlier in this report, vegetation removal within the WIZ can negatively affect the large woody debris frequency necessary to maintain a healthy stream. This impact would be offset by felling trees into the intertrail islands that would remain within the WIZ to improve LWD density. In addition, scatter cut branches on trails or pile along the edge of ski runs and discourage guests from skiing the interior of intertrail islands in the WIZ to promote maximum vegetative growth in the riparian areas. Implementation of these design criteria would contribute to maintain the long-term stream health and thus be consistent with the WCPH.

Current CDA within the Westfall Creek watershed totals approximately 4.5 acres. The existing connected disturbance has resulted in a 5 percent increase in the channel network length. Approximately 0.25 acre of additional CDA could result from implementation of the Proposed Action as a consequence of vegetation removal and grading within Westfall Creek's WIZ. In order to maintain or improve the stream health, impacts resulting from re-grading would be fully mitigated. All proposed areas to be re-graded would be protected from erosion by effective revegetation with a weed-free seed mix approved by the Forest Service. Additionally, water bars would be designed, constructed, and maintained to direct surface runoff away from the WIZ.

The field investigation conducted during the summer of 2011 identified opportunities for mitigation of existing impacts to watersheds within the study area, including the disconnection of approximately 2.7 acres of an existing ski trail and mountain road currently connected to the stream. This area is located where the Golden Eagle ski trail crosses over Westfall Creek. Disconnection would be achieved by enhancement of existing ski trail vegetation and construction of water bars that would direct and discharge surface runoff into forested areas away from the WIZ. Implementation of these mitigation measures would comply with the direction of "maintain or improve long-term stream health" included in MM-3.

Proposed Snowmaking

Also under the Proposed Action, snowmaking infrastructure would be installed to cover an additional 34 acres of ski trails, requiring 31 AF of water to be imported to the watershed (in the form of man-made snow). This additional snowmaking water represents a 32 percent increase in current snowmaking water usage within the Westfall Creek watershed (from the current 96 AF to 127 AF). These new and additional activities proposed under Alternative 2 would result in increases in water yield and peak streamflow. As shown in Table 3I-12 and Table 3I-13, these increases are estimated to be 34 AF and 0.5 cfs respectively (3 percent and 5 percent relative to current conditions) and would be relatively minor as compared to the natural hydrologic variability of Westfall Creek. Also, the impacts to the watershed yield and peak flow would be minimized by enhancing ski trail vegetation where possible and by constructing water bars that direct surface runoff towards well vegetated areas. Implementation of the proposed snowmaking

following the aforementioned PDF would be consistent with the WCPH and would not adversely impact the health of Westfall Creek.

Westfall Creek Channel Alteration

The entire Red Tail Camp area is proposed to be re-graded and re-configured to accommodate a larger finish area that can be used for men's and women's Alpine racing events. Approximately 6.9 acres of this area are proposed to be re-graded and 0.3 acre is proposed for overstory vegetation removal and grading. The proposed re-configuration of Red Tail Camp finish area includes the following projects:

- Replace and realign the culverted portion of Westfall Creek that runs through the Red Tail Camp area.
- Culvert an approximate 150-foot stretch of Westfall Creek (currently not culverted) that runs through the Red Tail Camp area.

The 150-foot section of Westfall Creek proposed to be piped provides a relatively low hydrologic function to the watershed because it is located between 2 culverts within a developed area. In order to comply with Forest Service Region 2 guidance for "maintaining or improving" watershed conditions, a 285-foot section of stream channel would be designed and constructed to convey a reach of Westfall Creek that is currently piped under *Peregrine*. Replacing the existing culvert on *Peregrine* by a restored channel would extend the hydrologic continuity of Westfall Creek from the current 1,700 feet to approximately 2,200 feet. In addition, a riparian vegetation fringe would be created along the restored channel in order to effectively recreate its functional value. Following these PDF, the 285-foot restored stream channel would fully mitigate the loss of the 150-foot stretch of Westfall Creek in the Red Tail Camp area.

A preliminary design of the proposed stream channel has been completed to demonstrate the feasibility of the mitigation. This design effort included a field survey of the creek's longitudinal slope and typical cross section within a 170-foot channel reach immediately upstream of the proposed mitigation site. A Wolman pebble count and hydraulic/hydrologic analysis were also conducted for this reach of Westfall Creek.²¹⁴ The proposed stream channel would have a length of approximately 285 linear feet and an average slope of 18 percent, similar to Westfall Creek channel slope above and below the location of the proposed restored channel. The proposed channel would be approximately 3 feet wide and resemble the substrate of the existing channel reach located immediately above the mitigation site. The proposed channel would have step-pool bedforms typical of Westfall Creek and would be constructed using on-site materials.

It is important to note that the existing 42-inch corrugated metal pipe culvert would be temporarily left in place in order to convey a portion of the seasonal Westfall Creek high flows to prevent damage to the

²¹⁴ Overton et al., 1997; Bathurst, 1987; Capesius & Stephens, 2009

constructed channel and growing riparian vegetation. Once the restored stream channel has stabilized, the 42-inch culvert would be removed.

The following PDF will be important for the success of the proposed mitigation measure:

Channel Design: Beaver Creek Resort will prepare an engineered channel design for the review and approval of WRNF resource specialists. The channel design will include, at a minimum, the following components:

- Longitudinal profile and typical cross sections, based upon existing channel reaches located immediately upstream and downstream of the proposed mitigation site.
- The channel substrate will be composed of native material of similar size distribution to those present in Westfall Creek just above the proposed mitigation site.
- The step-pool bedforms will be formed with key pieces properly sized and anchored in order to sustain the 100-year flood event.
- The channel slope, dimensions, and hydraulic characteristics will be designed to maintain adequate sediment transport capability throughout the entire length of the mitigated channel.
- Streambanks on the proposed channel will be vegetated with shrubs and willows transplanted from the riparian vegetation existing in Westfall Creek above and/or below the proposed mitigation site.
- Construction will occur during low flow conditions, as directed by WRNF hydrologists.
- A construction erosion control plan will be developed for review and approval by WRNF personnel.

Prior to construction of the 285-foot segment of stream channel, proposed snowmaking pipe would be installed underneath the channel at a depth sufficient to avoid impacts to the stream once it is in place. This section of pipeline would likely need to be lower in depth than those on either side of the channel. Long-term maintenance of the snowmaking pipeline in this area would be approved by a Forest Service specialist.

Alteration of Swale in the vicinity of Westfall Creek

Proposed grading and trail widening below the intersection of *Peregrine* and *Goshawk* in conjunction with the women's Downhill racecourse would impact an existing swale located near Westfall Creek. Currently, this swale conveys surface runoff seasonally, in response to snowmelt, for about 730 linear feet before infiltrating into the ground, at a point approximately 160 feet from Westfall Creek. Riparian vegetation does not exist along this swale. Furthermore, no evidence of annual scour and sediment deposition were observed within the swale. Approximately 230 linear feet of the swale immediately above where it infiltrates into the ground would be impacted by grading, and would need to be culverted.

Construction drawings and a sediment control plan would be developed and submitted for approval by the WRNF. The pipe would be designed and installed following standard engineering practices as approved by the WRNF. The swale is not a component of the Westfall Creek's channel network and it is not anticipated that this proposed project would have an impact on the watershed's health.

Construction and implementation of the Proposed Action within the Westfall Creek watershed as described above would be consistent with management measures included in the WCPH.

Upper Beaver Creek

Impacts to WIZ and Proposed CDA

Alternative 2 projects within the Upper Beaver Creek watershed include improvement of an existing utility corridor between Red Tail Camp area and the *Dally* catwalk to improve skier and rider circulation. The improvement would include widening the trail and installing snowmaking infrastructure. This project would re-grade approximately 0.4 acre of a road currently existing within Beaver Creek's WIZ. The catwalk would be designed, constructed, and maintained to drain away from the WIZ by insloping the road to the ditch. The ditch would be constructed and maintained to discharge into well vegetated areas.

Under Alternative 2, a new 150,000-gallon water tank and associated infrastructure would be installed on the edge of Paint Brush, below the *Beaver Creek Expressway*. In addition, an existing 4-inch domestic water line between Beano's Cabin and the Red Tail Camp area and a sewer line from Red Tail Camp down *Dally* would be replaced. Construction associated with these projects would take place within areas of the WIZ currently affected by roads and ski trail development and therefore these projects would not involve additional impacts to Upper Beaver Creek's WIZ. Erosion and sediment control BMPs would be implemented prior to construction and until temporarily disturbed soils have stabilized. Also, disturbed areas would be re-vegetated utilizing USFS certified seed mix and mulch. Implementation of these improvements within the Upper Beaver Creek watershed as described above would be consistent with management measures included in the WCPH.

Proposed Snowmaking

The Proposed Action would expand the snowmaking infrastructure to cover an additional 38 acres of ski trails, requiring approximately 34 AF of water to be imported to the watershed (in the form of man-made snow). The new snowmaking coverage proposed under Alternative 2 would result in a slight increase in Upper Beaver Creek's annual yield of 0.5 percent relative to existing conditions. No changes to peak streamflow are expected to occur. These increases would be negligible as compared to the natural hydrologic variability of Upper Beaver Creek. No measurable effects to stream bank stability, pool depth, wood frequency and streambed sediment are expected to occur on Upper Beaver Creek following implementation of Alternative 2. Therefore, implementation of the proposed snowmaking would be consistent with the WCPH.

Table 3I-14, below, provides a summary of the potential impacts to the study watersheds by issue and indicator.

CUMULATIVE EFFECTS

Appendix A includes a list of past, present, and reasonably foreseeable future projects have been identified by the Forest Service as relevant from a cumulative effects context.

Temporal and Spatial Extent of Analysis

The stream health effects of increased watershed yield and peak flows are most evident in the directly affected on-mountain drainages. The study watersheds drain to the Eagle River, where the effects of changes in flow are negligible relative to the hydrology of this larger watershed. Thus, from a stream health and water yield perspective, the downstream spatial boundary for the cumulative effects analysis is defined at a point immediately downstream of the project area.

The temporal extent of the analysis commences with conditions before the development of Beaver Creek, extending through the history of the Resort to the present, and includes the lifespan of current proposed projects as well as those that are current reasonably foreseeable future actions, in general 5 to 10 years after implementation of the Proposed Action.

Present and Reasonably Foreseeable Future Actions

Watersheds subjected to activities associated with ski area management, including trail construction and snowmaking, tend to exhibit cumulative changes to channel conditions, with differing corresponding dynamic equilibria, as compared to watersheds in undeveloped conditions. These changes are caused by increases in peak snowmelt magnitude, timing, and duration due to the effects of trail clearing, trail grading, and snowmaking. Affected channel reaches typically exhibit long term, continuing adjustments to their dynamic equilibria due to accelerated water inputs caused by both snowmaking and trail construction. Cumulative effects in watersheds within the defined Spatial and Temporal scales are often realized as higher intensity peak flows of shorter duration as compared to pre-development conditions, and could potentially result in bank instability, channel sedimentation, and decreased wood frequency.

When considered with the affects of past development and future potential development Alternative 1 would not contribute any additional impacts to past, present and reasonably foreseeable future affects. Since the stream health of the Upper Beaver Creek Watershed is generally Robust, it can be inferred that the current management is not cumulatively impacting the Watershed. However, the cumulative effects of the development of Beaver Creek Resort are reflected in the prevalence of slope stability issues within the existing ski area operational boundary (a result of increased water yield as well as the geology and soils within the SUP area).

Alternative 2 would increase water yield and peak flows as well as tree removal within the WIZ, adding to the cumulative changes in the watershed hydrologic functionality since the beginning of development at Beaver Creek. However, the Proposed Action's direct and indirect effects to stream health at the defined spatial and temporal scales are minimal and would continue to be reduced through implementation of PDF, such as disconnection of 2.7 acres of existing connected disturbed area. This would have a beneficial effect to the cumulative CDA within the study area. Moreover, with continued implementation of Beaver Creek's Drainage Management Plan, existing and future impacts to the study watersheds would be minimized. Therefore, the Proposed Action should have no cumulative effects on the stream health of the study area.

Beaver Creek Forest Health Project

The MPB Treatment Project would involve clear cut and thinning of approximately 115 acres within the study area. About 6 acres of this total would occur within currently forested WIZ. Within both the Westfall Creek and Upper Beaver Creek watersheds, the treatments would likely be applied at an approximate maximum rate of 10 acres per year. Implementation of the MPB Treatment Project could increase water yield on the study area by approximately 5 percent relative to existing conditions. However, it is expected that recovery of treated areas would occur over time, thus reducing water yields in the long-term. Furthermore, the MPB Treatment Project would comply with Forest Service standards and thus would not have cumulative effects on the stream health or water quality within the study area.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

There are no known irreversible or irretrievable commitments of watershed resources associated with the Proposed Action.

J. WETLANDS

SCOPE OF THE ANALYSIS

The scope of the wetlands analysis focuses on resources within the Beaver Creek SUP area with potential to be affected by implementation of any of the proposed projects. This analysis describes existing and anticipated conditions wetlands within the Study Area. Wetlands within the proposed disturbance area were delineated during field surveys; Forest Service data and the National Wetlands Inventory were used to determine wetlands for the remainder of the Study Area.

U.S. ARMY CORPS OF ENGINEERS DIRECTION

The *U.S. Army Corps of Engineers Wetlands Delineation Manual*, hereinafter referred to as 1987 Manual, and the Interim Regional Supplement, defines wetlands as “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.”²¹⁵ Wetlands generally include swamps, marshes, bogs, and similar areas. Activities within and near these areas, including tree removal, culvert installation, grading, and changes in runoff regimes may affect the ecological functions of wetland resources. Impacts to wetlands are regulated by Section 404 of the Clean Water Act (CWA), and such activities would require issuance of a permit from the U.S. Army Corps of Engineers (USACE).

According to the 1987 Manual, wetlands that have been disturbed through natural and/or anthropogenic alteration of hydrology, soils, and/or vegetation do not necessarily exist under “normal circumstances.”²¹⁶ “Normal circumstances” has been further defined as “the soil and hydrologic conditions that are normally present, without regard to whether the vegetation has been removed.”²¹⁷ Examples of alteration may include: removal of vegetation, removal of soil, placement of fill, channelization, drainage, fires, beaver dams, etc. Areas that do not exist under “normal circumstances” require modified wetland delineation techniques identified as the “Atypical Method for Delineation” in the 1987 Manual. Due to grading and vegetation removal for ski trail development, portions of the Study Area were determined to exist under “atypical circumstances.” Therefore wetlands within the Study Area were delineated using one of the appropriate protocols for either the “routine approach” or the “atypical method.”

FOREST PLAN DIRECTION

The 2002 Forest Plan includes one pertinent guideline outlining management direction for riparian areas and wetland resources on NFS lands (specified below). Pursuant to the Forest Plan, as amended, stream health management measures and design criteria are provided in the Region 2 Watershed Conservation

²¹⁵ Environmental Laboratory, 1987, 2010; Cowardin et al., 1979

²¹⁶ Id.

²¹⁷ RGL 90-7, 1990

Practices Handbook (WCPH) to ensure applicable Federal and State laws are met on NFS lands in Region 2.²¹⁸ The WCPH contains several Management Measures of relevance regarding the protection of riparian areas and wetlands.

Forest-wide: Water and Riparian Resources

- Guideline 2. Keep vehicles and equipment out of streams, lakes, and wetlands except to cross at designated points, build crossings, do restoration work, or where protected by 1 foot of snowpack or frozen soil.

Applicable WCPH Management Measures (MM)

- MM-1. Manage land treatments to conserve site moisture and to protect long-term stream health from damage by increased runoff.
- MM-2. Manage land treatments to maintain enough organic ground cover in each activity area to prevent harmful increased runoff.
- MM-3. In the water influence zone (WIZ) next to perennial and intermittent streams, lakes, and wetlands, allow only those actions that maintain or improve long-term stream health and riparian ecosystem condition.
- MM-6. Maintain long-term ground cover, soil structure, water budgets, and flow patterns of wetlands to sustain their ecological function.
- MM-10. Construct roads and other disturbed sites to minimize sediment discharge into streams, lakes, and wetlands.
- MM-11. Stabilize and maintain roads and other disturbed sites during and after construction to control erosion.

EXECUTIVE ORDER 11990

Additional direction regarding wetlands management for the USACE and Forest Service is provided by Executive Order (EO) 11990 – Protection of Wetlands. Presidential EO 11990 requires federal agencies to avoid to the extent practicable, long- and short-term adverse impacts associated with the destruction or modification of wetlands. More specifically, EO 11990 directs federal agencies to avoid new construction in wetlands unless there is no reasonable alternative. The Order states further that where wetlands cannot be avoided, the proposed action must include all practicable measures to minimize harm to wetlands. As required by EO 11990 and the CWA, avoidance and minimization measures must be considered through the planning process. Therefore, this section also identifies planning constraints with regard to terrain development.

²¹⁸ USDA Forest Service, 2002a; USDA Forest Service, 2006

AFFECTED ENVIRONMENT

Wetlands

Wetlands within the Study Area consist of groundwater seeps and riparian wetland systems fed by Westfall Creek and several unnamed tributaries to Beaver Creek. All of the wetlands delineated within the Study Area were identified as jurisdictional wetlands.²¹⁹ Some of the wetlands delineated were disturbed during previous resort development by grading, rerouting water and/or vegetation removal and were authorized by a 404 Permit. Wetlands that have been previously disturbed are in various stages of regeneration and continue to exhibit the necessary characteristics of a wetland under “atypical situations” though hydric soil, vegetation or hydrology indicators may have been lacking at the time of the delineation. These wetlands that have been previously disturbed are generally reduced in value for wildlife due to impacts that have reduced vegetative cover and or changed characteristics of the hydrology.

Wetlands within the Study Area offer varying degrees of value as wildlife and plant habitat, water storage locations and water filtration qualities. Wetlands 1 through 8 have largely maintained wetland vegetation and soils therefore they are able to function for wildlife and water resources. Wetland 5 is a particularly high quality wetland with organic soils measuring 24 inches, classifying it as a fen wetland. Not only do fens have good water holding capacity and purification values, but they also have high nutrient levels and plant diversity, and can provide environmental characteristics (soils, moisture, temperature and light) for quality habitat.²²⁰ Wetlands 2, 3 and 7 were likely divided from a single wetland during road and ski trail construction and subsequent stream culvert installation, but have maintained wetland function and values. The lower portion of wetland 4 (the portion that is shown within the ski trail) was graded in 1980’s when the trail was developed. Although most of this wetland maintains its function and values, vegetation and soils in the lower portion of the wetland have been removed and no longer provide habitat characteristics or hydrologic storage or filtration value. The same effect has occurred in wetlands 9 and 10 which were also graded; the loss of wetland vegetation and soils has reduced their function and value.

Wetland classification is based on the Cowardin classification system.²²¹ The Cowardin system classifies wetlands primarily by dominant plant community. Two types of jurisdictional wetlands were identified within the Study Area consisting of palustrine emergent (PEM) and palustrine shrub/scrub (PSS). Dominant wetland vegetation at Beaver Creek includes *Salix planifolia*, *Carex sp.*, *Equisetum arvense*, *Aconitum columbianum*, *Heracleum lanatum*, *Veratrum viride*, *Populus tremuloides*, *Abies lasiocarpa*, *Pinus contorta*, and *Picea engelmannii*.²²²

²¹⁹ As previously mentioned, wetlands were delineated following standard protocols. However, a formal jurisdictional determination has not been provided by the U.S. Army Corp of Engineers.

²²⁰ <http://water.epa.gov/type/wetlands/fen.cfm> accessed October 5th

²²¹ Cowardin et al., 1979

²²² These species are known to occur in wetlands at Beaver Creek, but are not necessarily indicative of wetlands.

Palustrine Emergent Wetlands

Palustrine emergent wetlands (PEM) have been identified across 0.26 acre within the Study Area. This wetland class is characterized by the presence of erect, rooted, usually perennial, herbaceous hydrophytic plants.²²³ *Carex* sp., *Equisetum arvense*, *Aconitum colubianum* and *Heracleum lanatum* were the dominant plants. Low chroma soil matrices and a thick organic layer, 8 inches or greater, were characteristic of these hydric soils. PEM wetlands throughout the Study Area were generally located within riparian zones of perennial drainages. However, the high quality fen wetland delineated near the Westfall road (Wetland 5) is a ground water fed peat forming wetland, with PEM wetland vegetation such as *Carex* sp. and *Pedicularis groenlandica*.

Palustrine Shrub/Scrub Wetlands

Palustrine shrub/scrub (PSS) wetlands were most common within the Study Area, totaling approximately 2.9 acres. Cowardin et al. has defined this type of wetlands as being dominated by a woody vegetation community composed of shrubs and young trees less than 6 feet tall.²²⁴ The dominant species present within these wetlands includes *Salix planifolia*. The majority of the PSS wetlands found within the Study Area were also found within riparian zones of perennial drainages in the area.

PSS/PEM Wetlands

Approximately 0.2 acre of PEM/PSS mosaic wetlands were delineated within the Study Area. These wetlands were dominated by a mix of PEM/PSS dominant species including *Salix planifolia*, *Aconitum colubianum* and *Heracleum lanatum*. Wetland 6 is the PEM/PSS mosaic, immediately downhill of the high quality FEN wetland. These wetlands were saturated to the surface and had approximately 10 inches of low chroma hydric soils.

Identified wetland type and acreage are presented Table 3J-1.

²²³ These species are known to occur in wetlands at Beaver Creek, but are not necessarily indicative of wetlands.

²²⁴ These species are known to occur in wetlands at Beaver Creek, but are not necessarily indicative of wetlands.

**Table 3J-1:
Wetlands Identified within the Study Area**

Watershed	Water Resource Wetland Class	Acreage
Westfall Creek	PSS	0.38
	<i>Total</i>	<i>0.38</i>
Beaver Creek	PEM	0.26
	PEM/PSS	0.22
	PSS	2.88
	<i>Total</i>	<i>3.36</i>

Note: Westfall Creek is within the Beaver Creek watershed, however to remain consistent with the Water Resources section of this FEIS, which identifies numbers specific to the Westfall Creek drainage basin in order to best identify affects, the Wetlands Section also splits out Westfall Creek from the total Beaver Creek drainage.

Ten wetland areas were identified within the Study Area. Perennial streams feeding wetlands within the Study Area are Westfall Creek and Beaver Creek. Westfall Creek is culverted in five locations within the project area (under Westfall Road, under Peregrine, under Red Tail trail, and twice in the Red Tail Camp area). Beaver Creek is culverted once in the project area under Beaver Creek Mountain Express Way (in the Red Tail Camp area). Rerouting the water in these main drainages has likely affected associated wetlands in the past.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

No operational or infrastructural changes/additions would occur on NFS lands within Beaver Creek's SUP area as a result of the No Action Alternative. Therefore, the No Action Alternative would have no additional direct or indirect environmental impacts to wetlands.

Alternative 2 – Proposed Action

In accordance with EO 11990, the Proposed Action was designed to avoid and minimize impacts to wetlands wherever possible. During project design, modifications were made to the Proposed Action to route new waterlines from the new water tank on *Beaver Creek Mountain Expressway* and *Paintbrush* rather than through a wetland and stream channel on *Ford's Way*. The Proposed Action has been designed to avoid wetland impacts from installation of snowmaking infrastructure to the greatest extent practicable.

Overstory vegetation removal would occur within 0.07 acre of wetland 4 and would convert a portion of the PSS wetland to PEM wetland. Flush-cutting of willows would result in increased amounts of solar radiation reaching the ground and increased available moisture (resulting from decreased evapotranspiration rate) which would favor some plants over others. Although these affects would result

in a change environmental characteristics such as moisture, temperature and light this wetland would still provide hydrologic and habitat functions and values.

To minimize potential for ground disturbance in wetlands, known wetlands would be flagged prior to any construction activity. Additionally, overstory tree removal within wetland 4 would be performed by hand. Trenches for snowmaking infrastructure would be dug outside wetland boundaries and spoils would be stored in upland areas until the trench is backfilled after construction is complete. Appropriate erosion control would be maintained to keep sediment out of wetlands and stream channels.

CUMULATIVE EFFECTS

Appendix A includes a list of past, present, and reasonably foreseeable future projects have been identified by the Forest Service as relevant from a cumulative effects context.

Temporal and Spatial Extent of Analysis

The spatial extent of the cumulative effects analysis are the wetlands within Beaver Creek Watershed below the confluence with Westfall Creek.

The temporal bounds for this cumulative effects analysis for wetlands resources extends from Beaver Creek's inception as a resort, to five to ten years into the future when the project has been fully implemented and mitigation is complete.

Past Ski Area Projects

Although wetlands have been disturbed from ski area development (clearing, grading and infrastructure developments) the No Action and Proposed Action would not have any direct or indirect affects to wetlands resources, therefore there would be no cumulative effects related to approval of either of these alternatives.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

No irreversible and/or irretrievable commitments of wetland resources have been identified in association with either alternative analyzed in this document due to the requirement of no net loss of wetland function and value.

K. CULTURAL, ARCHAEOLOGICAL, AND HERITAGE RESOURCES

SCOPE OF THE ANALYSIS

This cultural resource assessment is mandated by the National Historic Preservation Act of 1966 (NHPA). Section 106 of the NHPA requires that federal agencies take into account the effects of a federal undertaking on any cultural resource that is included in or eligible for inclusion in the National Register of Historic Places (NRHP). Cultural resources may refer to sites, areas, buildings, structures, districts, and objects which possess scientific, historic, and/or social values of a cultural group or groups as specified by 36 CFR 296.3.

This assessment is based on file searches indicating that four sites are located within the project area, in close proximity to proposed development areas. Therefore, these sites were inspected in September 2011. Seven inventories have been conducted in the past to cover the proposed project area; these inventories are identified in the technical report contained in the project file. NRHP eligibility is evaluated in terms of the integrity of the resource; its association with significant persons, events, or patterns in history or prehistory; its engineering, artistic, or architectural values; or its information potentially relative to important research questions in history or prehistory.²²⁵ The significance of NRHP eligibility of cultural resources is determined by the Forest Archaeologist in consultation with the State Historic Preservation Officer (SHPO).

AFFECTED ENVIRONMENT

The files of the Colorado Office of Archaeology and Historic Preservation (OAHP) Compass database and the WRNF were consulted prior to the initiation of fieldwork. Four sites are located close to proposed development areas; one additional site that was originally thought to be near the proposed development area was re-plotted based on the UTM coordinates provided on the site form and the location was discovered to be more than 400 feet north of the project area.

Two of the sites were recorded as prehistoric lithic scatters, however, the site's artifacts had been almost completely collected and no surface artifacts were found in either location. The archaeologist determined that one of the sites was outside the area of potential effect (APE), and the other had mostly been obliterated by construction of the road to Beano's cabin and no further work was recommended. The other two sites identified during the file search appeared to be separate sites from the reports, but in the field they were identified as a prehistoric lithic scatter and log cabin associated with old Beano's cabin. The historic cabin has mostly been reconstructed since the last recording in 2002 (at that time it was recommended as not eligible to the NRHP) and no signs of the associated prehistoric lithic scatter were found. The archaeologists did not find any evidence of possible buried cultural deposits as there was no evidence of intact soils and road base surrounds the cabin. Due to the current condition of the area, the

²²⁵ 36 CFR Section 60.4

archeologist recommended that neither the old Beano's cabin, nor the adjacent lithic scatter, is eligible for the National Register and no further work is recommended.

DIRECT AND INDIRECT ENVIRONMENTAL CONSEQUENCES

Alternative 1 – No Action

Because no ground disturbance is proposed under the No Action Alternative, there is no potential to affect the historic sites within the APE as a result of the No Action Alternative.

Alternative 2 – The Proposed Action

All inventory reports were submitted to the SHPO in completion of the NHPA Section 106 process. Implementation of the Alternative 2 was determined to have "no effect" on any known NRHP listed or eligible historic properties. Written concurrence regarding this project was received on November 28, 2011.

As stated in the Project Design Features (Table 2-1), if previously-unknown Native American cultural resources, artifacts, or human remains are discovered during implementation of any approved projects, all ground disturbing activities will cease, and government-to-government consultation with Native American Tribes will commence.

CUMULATIVE EFFECTS

Appendix A includes a list of past, present, and reasonably foreseeable future projects have been identified by the Forest Service as relevant from a cumulative effects context.

Temporal and Spatial Extent of Analysis

The spatial extent of the cumulative effects analysis is limited to NFS lands within the SUP area and adjacent private ski area land.

The temporal bounds for this cumulative effects analysis for cultural resources extends from Beaver Creek's inception as a resort, to five to ten years into the future when the project has been fully implemented.

Past Ski Area Projects

Although NRHP-eligible cultural resource may have been disturbed by ski area development in the past, no NRHP-eligible cultural resources are identified within the APE related to Alternative 2; therefore, by definition, no cumulative effects would occur or require further analysis.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

No irreversible and/or irretrievable commitments of cultural resources have been identified in association with either of the alternatives analyzed in this document.

Chapter 4

Consultation and Coordination

4. CONSULTATION AND COORDINATION

A. PREPARERS

FOREST SERVICE TEAM

The following people participated in initial scoping, were members of the Interdisciplinary Team, and/or provided direction and assistance during the preparation of this EIS.

Scott Fitzwilliams	White River National Forest Supervisor, Responsible Official
Dave Neely	Eagle/Holy Cross District Ranger
Don Dressler	ID Team Leader, Winter Sports Administrator, Holy Cross RD
Mark Weinhold	Hydrologist, SO
Matt Grove	Fisheries Biologist, Eagle/Holy Cross RD
Elizabeth Roberts	Wildlife Biologist, SO
Rick McNeill	Botanist, East Zone
Jared Pierce	Landscape Architect, SO
Brian McMullen	Soil Scientist, SO
Patrick Uphus	Archaeologist, SO

CONSULTANT TEAM

The use of a third party consulting firm for preparation of an EIS is addressed in the Code of Federal Regulations at 40 CFR Title 40, Part 1506.5(c). If an EIS is prepared with the assistance of a consulting firm, the firm must execute a disclosure statement, as indicated below:

Except as provided in §§1506.2 and 1506.3 any environmental impact statement prepared pursuant to the requirements of NEPA shall be prepared directly by or by a contractor selected by the lead agency or where appropriate under §1501.6(b), a cooperating agency. It is the intent of these regulations that the contractor be chosen solely by the lead agency, or by the lead agency in cooperation with cooperating agencies, or where appropriate by a cooperating agency to avoid any conflict of interest. Contractors shall execute a disclosure statement prepared by the lead agency, or where appropriate the cooperating agency, specifying that they have no financial or other interest in the outcome of the project. If the document is prepared by contract, the responsible Federal official shall furnish guidance and participate in the preparation and shall independently evaluate the statement prior to its approval and take responsibility

for its scope and contents. Nothing in this section is intended to prohibit any agency from requesting any person to submit information to it or to prohibit any person from submitting information to any agency.

Accordingly, a disclosure statement was signed by the third party consulting team.

SE Group – Frisco, CO

Kent Sharp	Principal-in-Charge
Jason Marks	Senior Project Manager
Kelly Owens	Assistant Project Manager/Biologist/GIS Analyst
Chris Ward	Silviculturalist/Environmental Analyst
Melissa Sherburne	GIS Analyst
Paula Samuelson	Production Specialist

Metcalf Archeological Consultants – Eagle, CO

Anne McKibbin	Principal Archeological Investigator
---------------	--------------------------------------

Resource Engineering, Inc. – Glenwood Springs, CO

Scott Fifer	President/Hydrologist
Raul Passerini, P.E.	Water Resources Engineer

Western Ecosystems, Inc. – Boulder, CO

Rick Thompson	Wildlife Biologist
---------------	--------------------

B. AGENCIES, ORGANIZATIONS, TRIBAL GOVERNMENTS, AND PERSONS CONTACTED

FEDERAL GOVERNMENT

US Army Corps of Engineers

US Environmental Protection Agency

US Fish and Wildlife Service

TRIBAL GOVERNMENT

Southern Ute Indian Tribe

Ute Indian Tribe

Ute Mountain Tribe

STATE GOVERNMENT

Colorado Department of Transportation

Colorado Department of Natural Resources

Colorado Division of Water Resources

Colorado Division of Wildlife

State Historic Preservation Office (SHPO)

LOCAL GOVERNMENT

Eagle County Government

Town of Avon

INDIVIDUALS WHO COMMENTED DURING THE DEIS

Barry Bryant

Kyle Nelson

Benjamin Cooperman

Jan Nordh

Jonathan Corchnoy

Steve Prawdzik

Dudley Duel

Scott Prince

Robert Hamina

Aldo Radamu

Dan Holman

Pegasus Rumaine

Aaron Humphrey

John Santaniello

Jack Jefferies

Richard Sawyer

Allison Kent

Richard Schnelle

Yuri Kostick

James Smith

Mark Luzar

Jerry Sorensen

Scot Marana

Heather Thomas

Dominic Mauriello

James Tombs

Chapter 5

References

5. REFERENCES

- 40 CFR 59, 80, 85 and 86. Control of Hazardous Air Pollutants from Mobile Sources. March 29, 2006.
- 42 USC 7470-7479. Public Health and Welfare.
- Alexander, K.D. and A.R. Ellingson. 2004. Uncompahgre fritillary butterfly monitoring and inventory: 2003 field report and status. Western State College, Gunnison, CO.
- Alexander, S. M., P.C. Paquet, and N.M. Waters. 2004. Carnivores, roads and habitat permeability in the Canadian Rocky Mountains: a community level study. Paper presented at the Defenders of Wildlife Carnivores 2004 Conf: expanding partnerships in carnivore conservation. Nov. 14-17, 2004, Santa Fe, NM.
- Alexander, S. M., N.M. Waters, and P.C. Paquet. 2005. Traffic volume and highway permeability for a mammalian community in the Canadian Rocky Mountains. *Can. Geographer*. 49:321-331.
- Allredge, A.W. 1998. Mud Springs Gulch deer underpass study, summer 1998. RFL Environmental. Red Feather Lakes, CO. 8 pp.
- Allredge, A.W. and M.W. Allredge. 2006. Pete's Bowl wildlife plots summary report 2003-2004. Unpubl. Rep., Thermopolis, WY. 15 pp.
- Andrews, R. and R. Righter. 1992. Colorado birds: a reference to their distribution and habitat. Denver Museum of Natural History. Denver, CO. 442 pp.
- Apps, C.D. 2000. Space-use, diet, demographics, and topographic associations of lynx in the southern Canadian Rocky Mountains: a study. Pages 351-371 in Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, G.M. Koehler, C.J. Krebs, K.S. McKelvey and J.R. Squires, eds. Ecology and conservation of lynx in the United States. Univ. Colorado Press and USDA Rocky Mtn. Res. Stn., USDA Gen. Tech. Rep. RMRS-GTR-30WWW. 480 pp.
- Armstrong, D.M. 1972. Distribution of mammals in Colorado. Univ. Kansas Mus. Nat. Hist. Mono. 3. 415 pp.
- Associated Press. 2010. Colorado explores reintroducing wolverines. *Denver Post*. Dec. 14.
- Aubry, K.B., K.S. McKelvey, and J.P. Copeland. 2007. Distribution and broadscale habitat relations of the wolverine in the contiguous United States. *J. Wildl. Manage.* 71:2147-2158.
- Bailey, A.M. and R.J. Niedrach. 1965. Birds of Colorado. Denver Mus. Nat. Hist. Denver, CO. 895 pp.
- Bailey, R.G. 1995. Ecoregions map of North America. Prep. in coop. with The Nature Conservancy and U.S. Dept. Interior Geological Survey. Wash., D.C. 10pp + map.
- Banci, V. 1994. Wolverine. Pages 99-127 in Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski, tech. eds. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. Gen. Tech. Rep. RM-254. USDA For. Serv. Rocky Mountain Range and Exper. Stn., Ft. Collins, CO. 184 pp.
- Banfield, A.W.F. 1974. The mammals of Canada. Univ. Toronto Press, Toronto. 438 pp.

- Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid bioassessment protocols for use in streams and wadeable rivers: periphyton, benthic macroinvertebrates and fish. Second ed. EPA 841-B-99-002. U.S. Environmental Protection Agency; Office of Water, Wash., D.C.
- Bartmann, R.M. and G. Byrne. 2001. Analysis and critique of the 1998 snowshoe hare pellet survey. Colorado Div. Wildlife, Denver, Div. Rep. No. 20. 10 pp.
- Bathurst, J. 1987. Critical Conditions for Bed Material Movement in Steep, Boulder-Bed Streams. Erosion and Sedimentation in the Pacific Rim (Proceedings of the Corvallis Symposium, August 1987). IAHS Publication No. 165.
- Bauer, S.B. and T.A. Burton. 1993. Monitoring protocols to evaluate water quality effects of grazing management on western rangeland streams. EPA 910/R-93-017. Seattle, WA. US. Environmental Protection Agency, Water Division, Surface Water Branch.
- Beaver Creek Resort. 2010. Master Development Plan Update.
- Beidleman, C.A. 2000. Partners in Flight land bird conservation plan, Colorado. Colorado Partners in Flight, Brighton, CO. Vers. 1.0. Available on the World Wide Web at <http://www.rmbo.org/pif/bcp/index.htm>
- Beier, P. and S. Loe. 1992. A checklist for evaluating impacts to wildlife movement corridors. Wildl. Soc. Bull. 20:434-440.
- Bennett, A.F. 1990. Habitat corridors and the conservation of small mammals in a fragmented forest environment. Landscape Ecol. 4:109-122.
- Bent, A.C. 1942. Life histories of North American flycatchers, larks, swallows, and their allies. U.S. Natl. Mus. Bull. 179. Wash. D.C.
- Bissell, S.J. 1978. Wolverine, *Gulo gulo* L. Pages 76-77. In Essential habitat for threatened and endangered wildlife in Colorado. Colorado Div. Wildl., Denver, CO. 84 pp.
- Black Gore TMDL Workgroup. 2007. Black Gore Creek total maximum daily load (TMDL) for sediment. B. D. Healy, chair. Draft submitted to the Colorado Department of Public Health and Environment, Water Quality Division. May 6, 2007.
- Blakesley, J.A. 2008. Draft, Population densities and trend detection of avian Management Indicator Species on the White River National Forest. Supplemental Report M-MCB-USFS07-02. Rocky Mountain Bird Observatory, Brighton, CO. 10 pp.
- Bleich, V.C., J.D. Wehausen and S.A. Holl. 1990. Desert-dwelling mountain sheep: conservation implications of a naturally fragmented distribution. Conserv. Biol. 4:383-390.
- Boals, C.W. 1994. A photographic and behavioral guide to aging nestling northern goshawks. Studies in Avian Biology No. 16:32-40.
- Boreal Toad Conservation Strategy Team. 1997. Draft conservation strategy for the southern Rocky Mountain population of the boreal toad (*Bufo boreas boreas*). U.S. Fish and Wildlife Service. Denver, CO.
- Boreal Toad Recovery Team. 1998. Boreal toad conservation plan and agreement. Colorado Div. Wildl., Denver, CO.

- . 2005. Southern Rocky Mountain boreal toad breeding locality monitoring summary – 2004, BTRT, Colorado Div. Wildl., Den, CO. 68pp.
- . 2006. Report on the status and conservation of the boreal toad, *Bufo boreas boreas*, in the Southern Rocky Mountains, 2005. T. Jackson, Coord./ ed. CDOW, Denver, CO. Feb. <http://wildlife.state.co.us/NR/rdonlyres/64D119FD-DC6C-4DA8-B4EF-CB039935888D/0/BUBOstatus2005.pdf>
- . 2008. Boreal Toad Recovery Team 2008 meeting minutes, March 12 & 13, 2008, Comfort Inn, Alamosa, CO. Colorado Div. Wildl., Denver, CO. 12 pp.
- . 2010. 2010 monitoring assignments, BTRT, Colorado Div. Wildl., Den, CO. 3pp.
- Boutin, S. 1979. Spacing behaviour of snowshoe hares in relation to their population dynamics. Unpublished M.S. Thesis, University of British Columbia, Vancouver. 141. pp (as cited in Fitzgerald et al. 1994)
- Boyd, R.J. 1970. Elk of the White River Plateau, Colorado. Tech. Bull. Colorado Div. Game, Fish, and Parks. Denver. 25:1-126.
- . 1978. American elk. Pages 11-29 in J.W. Schmidt and D.L. Gilbert. Big game of North America. Stackpole Books. Harrisburg, PA. 494 pp.
- Boyd, R.J. and E.E. Ryland. 1971. Breeding dates of Colorado elk as estimated by fetal growth curves. Colorado Div. Wildl. Info. Leaf. No. 88. 2 pp.
- Brand, C.J., L.B. Kieth, and C.A. Fisher. 1976. Lynx responses to changing snowshoe hare densities in central Alberta. Journal Wildlife Management 40:416-428.
- Braun, C. E. 1980. Alpine bird communities of western North America: implications for management and research. Pages 280-291 in Workshop proceedings of the management of western forests grasslands for nongame birds. (R. M. de Graff and N. G. Tilgman compilers). U. S. For. Serv. Gen Tech. Rep. INT No. 86.
- Brittall, J.D., R.J. Poelker, and S.J. Sweeney. 1989. Native cats of Washington. Washington Dept. of Wildlife. Unpubl. Rep. Olympia. 169 pp.
- Broderdorp, K. 2003. Problems with information being provided in Biological Assessments. USFWS, Grand Jct., CO. 3 pp.
- Burroughs, E.R. and J.G. King. 1989. Reduction of Soil Erosion on Forest Roads. G.T.R INT-264, Ogden, UT. USDA, Forest Service, Intermountain Research Station.
- Buskirk, S.W. 1983. Ecology of the marten in south-central Alaska. Univ. Alaska, Fairbanks. Ph.D. Thesis. 131 pp. (as cited in Buskirk and Ruggiero 1994).
- Buskirk, S.W. and L.F. Ruggiero. 1994. American marten. Pages 7-37 in Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski, tech. eds. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. Gen. Tech. Rep. RM-254. USDA For. Serv. Rocky Mountain Range and Exper. Stn., Ft. Collins, CO. 184 pp.

- Byrne, G. 1998. A Colorado winter track survey for snowshoe hares and other species. CDOW, Glenwood Springs. Unpubl. Rep. July 10. 35 pp.
- Byrne, G. and J. Copeland. 1997. An aerial survey for wolverine (*Gulo gulo*) in Colorado. Colorado Div. of Wild. Unpubl. Rep. 18 pp.
- Call, M.W. 1978. Nesting habitats and surveying techniques for common western raptors. BLM, Denver Serv. Center. Tech. Note TN-316. 115 pp.
- Campbell, T.M. 1979. Short-term effects of timber harvests on pine marten ecology. M.S. Thesis, Colorado State University, Fort Collins. Published in *The Relationship between Habitat and Furbearers*, by A.W. Allen. 1987. Pages 164-179. In *Wild Furbearer Management and Conservation in North America*, edited by M. Novak, J.A. Baker, M.E. Obbard, and B. Mallock. Ontario Ministry of Natural Resources, Canada.
- Carter, M.F., W.C. Hunter, D.N. Pashley, and K.V. Rosenberg. 2000. Setting conservation priorities for landbirds in the United States: The Partners In Flight approach. *Auk* 117:541-548.
- Capesius & Stephens. 2009. Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado. Scientific Investigations Report 2009-5136. U.S. Department of the Interior, U.S. Geological Survey.
- Cary, M. 1911. A biological survey of Colorado. *N. Amer. Fauna*. 33:1-256.
- Clark, T.W. and T.M. Campbell. 1977. Short-term effects of timber harvest on pine marten behavior and ecology. Idaho State Univ., Pocatello. 60 pp. (as cited in Fitzgerald et al. 1994)
- Clark, T.W., E. Anderson, C. Douglas and M. Strickland. 1987. *Martes americana*. *Amer. Soc. Mammal., Mammalian Species*, 289:1-8.
- Clark, T.W., M. Bekoff, T.M. Campbell, T. Hauptman, and B.D. Roberts. 1989. American marten, *Martes americana*, home ranges in Grand Teton National Park, Wyoming. *Can. Field-Nat.* 103:423-425.
- Clevenger, A.P., B. Chruszcz, K. Gunson, and J. Wierzchowski. 2002. Roads and wildlife in the Canadian Rocky Mountain parks – movements, mortality and mitigation. Final Report to Parks Canada. Banff, Alberta.
- Coleman, R. 2004. *Measuring Success 2: The Economic Impact of Major Events*, UK Sport.
- Colorado Department of Transportation. 2002. State of Colorado state highway access code. Vol. 2, Code of Colorado Regulations, 601-1, March.
- . 2011. Annual Average Daily Traffic (AADT) Volumes for Highway 070A. DTD DataAccess – Statistics, Maps and Data. <http://apps.coloradodot.info/dataaccess/Traffic>.
- Colorado Division of Wildlife. 1993a. Appendix A, WRIS, elk seasonal activity areas. Colorado Division of Wildlife. Feb. 2 pp.
- . 1993b. Wildlife Resource Information System scenario - draft. Elk, Data Analysis Unit E-16, Game Management Units 44, 444, 45, and 47. Colorado Division of Wildlife. 3 pp. vers. 2-23-93.
- . 2000. Whirling disease and Colorado's trout. CDOW, Denver. 4 pp.

- . 2002a. Wildlife Report. (1/14/02) DOW authority for deer, elk importation approved. www.dnr.state.co.us/cdnr_news 2 pp.
- . 2002b. Draft White River elk herd data analysis unit plans. Unpubl. draft docs.
- . 2004. Prevalence and distribution of chronic wasting disease in Colorado 2003-2004. Denver. 5 pp.
- . 2006a. JakeOmatic data analysis software, version 2.4, July.
- . 2006b. CDOW researchers release 2006 lynx kitten count. 8/8/2006 press release. <http://wildlife.state.co.us/newsapp/press.asp?pressid=3993>.
- . 2009a. Greenback cutthroat trout. CDOW website. June 12 update. <http://wildlife.state.co.us/WildlifeSpecies/Profiles/Fish/GreenbackCutthroat.htm>
- . 2009b. Lynx update. May, 25. <http://wildlife.state.co.us/NR/rdonlyres/1E7C95D0-53F3-41EB-82DD-26134C0FF261/0/LynxUpdateMay252009.pdf>
- . 2010. DOW declares Colorado lynx reintroduction program a success. Colorado Div. Wildlife, Denver. Sep. 17. <http://wildlife.state.co.us/NewsMedia/PressReleases/Press.asp?PressId=6650>
- Colorado Native Plant Society. 1989. Rare Plants of Colorado. Colorado Native Plant Society and the Rocky Mountain Nature Association. Estes Park, CO. 75 pp.
- . 1997. Rare Plants of Colorado (Second Edition). The Colorado Native Plant Society. Falcon Press Publishing Company (Helena, MT) and the Rocky Mountain Nature Association (Estes Park, CO). 105 pp.
- Colorado Natural Heritage Program. 1997. Colorado's Natural Heritage: Rare and Imperiled Animals, Plants, and Natural Communities. October, 1997. Vol. 3, No. 1. 226 pp.
- . 1999. Conservation Status Handbook -- Colorado's Animals, Plants, and Plant Communities of Special Concern. May, 1999. Vol. 3, No. 2. 259 pp.
- Colorado Partners in Flight. 2000. Land bird conservation plan, Physiographic Region 62: Southern Rocky Mountains. Rky. Mtn. Bird. Observ., Brighton, CO.
- Colorado River Cutthroat Trout Task Force. 2001. Conservation agreement and strategy for Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*) in the States of Colorado, Utah, and Wyoming. Colorado Division of Wildlife, Fort Collins. 87pp.
- Colorado River Cutthroat Trout Coordination Team. 2006. Conservation strategy for Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*) in the states of Colorado, Utah, and Wyoming. Colorado Division of Wildlife, Fort Collins, Colorado. 24 pp.
- Copeland, J.P. 1996. Biology of the wolverine in central Idaho. M.S. Thesis, Univ. of Idaho. 138 pp.
- Corn, P.S. and J.C. Fogelman. 1984. Extinction of montane populations of the northern leopard frog (*Rana pipiens*) in Colorado. J. Herpetol. 18:147-152.
- Council on Environmental Quality. 1997. Considering cumulative effects under the National Environmental Policy Act. Council on Environmental Quality, Executive Office of the President. Wash., D.C. 64 pp.

- Cowardin et al. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FWS/OBS-79/31, U.S. Fish and Wildlife Service, Office of Biological Services, Washington, DC.
- Craig, G.R. 1978. American peregrine falcon, *Falco peregrinus anatum*. Pages 40-45 in Essential habitat for threatened or endangered wildlife in Colorado. CDOW, Denver. 84 pp.
- Craig, G.R. and J.H. Enderson. 2004. Peregrine falcon biology and management in Colorado. Colorado Div. of Wildlife Techn. Publ. No. 43. DOW-R-T-43-04. CDOW, Denver, CO. 80 pp.
- Crockett, A.B. and P.L. Hansley. 1978. Apparent response of Picoides woodpeckers to outbreaks of the pine bark beetle. Western Birds. 9:67-70.
- Danby, R.K. and D.S. Hik. 2007. Variability, contingency, and rapid change in recent subarctic alpine tree line dynamics. J. Ecol. 95:352-363.
- Deems, E.F. and D. Pursley. 1978. North American furbearers: their management, research and harvest status in 1976. Int. Assoc: Fish Wildl. Agencies. Univ. Maryland, College Park, MD.
- DeMott, S.L. and G.P. Lindsey. 1975. Pygmy shrew, *Microsorex hoyi*, in Gunnison County, Colorado. Southwest. Nat. 20:417-418.
- Denver Business Journal. 2008. Colorado Sets Tourism Record with 28M Visitors in 2007. 24 June.
- Doerr, J.G. 2004. Biological evaluation for Forest Service sensitive species for the 2003 Upper Blue Land Stewardship Project FEIS, Dillon Ranger District, White River National Forest, Summit County, Colorado. USDA For. Serv., White River National Forest. Eagle Ranger District, Eagle, CO. 33 pp.
- Dolbeer, R.A. 1972. Population dynamics of snowshoe hare in Colorado. Ph. D. Diss., Colorado State University, Fort Collins.
- Dolbeer, R.A. and W.R. Clark. 1975. Population ecology of snowshoe hares in the central Rocky Mountains. J. Wildl. Manage. 39:535-549.
- Ehrlich, P.R., D.S. Dobkin and D. Wheye. 1992. Birds in jeopardy. Stanford Univ. Press, Stanford, CA. 259 pp.
- Ellingson, A.R. 2001. Uncompahgre fritillary butterfly monitoring and inventory: 2000 field report and recommendations. Unpubl. Rep. Uncompahgre Biol. Serv., Lake City, CO.
- Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual, Technical Report Y-87-1. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.
- . 2010. Regional Supplement to the Corps of Engineers Wetland Delineation manual: Western Mountains, Valleys, and Coast Region (Version 2.0).
- Environmental Law Resource. 2010. <http://www.environmentallawresource.com/2009/03/articles/climate-change/dodging-the-bullet-advice-to-facilities-whose-emissions-may-be-under-the-reporting-threshold-of-usepas-proposed-mandatory-ghg-inventory-reporting-regulations/>. Last accessed July 21.
- Ewer, R.F. 1973. The Carnivores. Cornell Univ. Press, Ithaca, NY. 494 pp.

- Ferland, C. 2005. Northern goshawk (*Accipiter gentilis atricapillus*) breeding status in the San Juan and Rio Grande National Forests, southwestern Colorado. Unpubl. Rep. prepared for the San Juan and Rio Grande National Forests, 26 January. 40 pp.
- Fifer, R.S. 2011a. Beaver Creek Mountain Improvements - 2011 EIS, Snowmaking Diversions and Consumptive Water Use, Technical Memorandum. Resource Engineering, Inc. Glenwood Springs, CO. Sep. 16, 16pp.
- . 2011b. Beaver Creek Mountain Improvements - 2011 EIS, Planned Expansion, Red Tail Camp Restaurant, technical memorandum. Resource Engineering, Inc. Glenwood Springs, CO. Sep. 16, 2pp.
- Finch, D.M. 1992. Threatened, endangered, and vulnerable species of terrestrial vertebrates in the Rocky Mountain Region. USDA-FS Gen. Tech. Rep. RM-215. Ft. Collins, CO.
- Fitzgerald, J.P., C.A. Meaney, and D.M. Armstrong. 1994. Mammals of Colorado. Denver Mus. Nat. Hist. and Univ. Press of Colorado. Niwot, CO. 467 pp.
- Forman, R.T.T. and M. Godron. 1986. Landscape ecology. John Wiley and Sons, New York, N.Y. 619 pp.
- Forman, R.T.T. and L.E. Alexander. 1998. Roads and their major ecological effects. *Ann. Rev. Ecol. Syst.* 29:207-231.
- Forman, R.T.T., D. Sperling, J. Bissonette, A.P. Clevenger, C. Cutshall, V. Dale, L. Fahrig, R. France, C.S. Goldman, K. Heanue, J. Jones, F. Swanson, T. Turrentine, and T. Winter. 2003. Road ecology: science and solutions. Wash., D.C. Island Press.
- Freddy, D.J. 1987. The White River elk herd: a perspective, 1960-85. Tech. Publ., Colorado Div. Wildl., Denver, CO. 37:1-64.
- Freddy, D.J., D.L. Baker, R.M. Bartmann, and R.C. Kufeld. 1993. Deer and elk management analysis guide, 1992-94. Div. Rep. No. 17. Colorado Div. Wildl., Ft. Collins, CO.
- Freddy, D.J., W.M. Bronaugh, and M.C. Fowler. 1986. Responses of mule deer to disturbance by persons afoot and snowmobiles. *Wildl. Soc. Bull.* 14:63-68.
- Gall, L.F. 1984. Population structure and recommendations for conservation of the narrowly endemic alpine butterfly, *Boloria acrocnema* (Lepidoptera: Nymphalidae). *Biol. Conserv.* 28:1-28.
- Gibeau, M.L. and K. Heuer. 1996. Effects of transportation corridors on large carnivores in the Bow River Valley. Pp. 67-79 in Proceedings of the Florida Department of Transportation/ Federal Highway Administration Transportation-Related Wildlife Mortality Seminar. G. Evink, D. Ziegler, P. Garrett and J. Berry, eds.
- Giezentanner, K. 2008. Draft White River National Forest 2007 Management Indicator Species evaluation, Rocky Mountain elk. USDA-FS, Glenwood Springs, CO. 25 pp. May.
- Goettl, J.P. and Boreal Toad Recovery Team. 1997. Boreal toad (*Bufo boreas boreas*) (southern Rocky Mountain population) recovery plan. Colorado Div. Wildl. Denver. 50 pp.

- Gonzalez, P., R.P. Neilson, K.S. McKelvey, J.M. Lenihan, and R.J. Drapek. 2007. Potential impacts of climate change on habitat and conservation priority areas for *Lynx canadensis* (Canada lynx). The Nature Conservancy, Arlington, VA. Oct. 2. 19 pp.
- Greig, M.S. and R.W. McQuaid. 2003. The Economic Impact of a Sporting Event: A Regional Approach, 43rd European Regional Science Association Congress, Jyväskylä, Finland. August.
- Grother, C., S. Kaye, and Pioneer Environmental Services. 1994. Biological assessment and Biological evaluation, Telluride Ski Area expansion, Norwood Ranger District, Grand Mesa, Uncompahgre, Gunnison National Forest. USFS, Norwood, CO.
- Groves, C.R. 1988. Distribution of the wolverine in Idaho as determined by mail questionnaire. Northwest Sci. 62:181-185.
- Hadley, G.L. and K.R. Wilson. 2002. Final report: effects of ski-run development on small mammal populations at Vail Ski Area. Colorado State Univ., Dept. Fishery and Wildlife Biol. Ft. Collins, CO. 53 pp.
- . 2004. Patterns of density and survival in small mammals in ski runs and adjacent forest patches. J. Wildl. Manage. 68:288-298.
- Halfpenny, J.C. 1981. History and status of wolverine in Colorado. Colorado Div. Wildl. Res. Rept. 1:6782.
- . 1986. A field guide to mammal tracking in western America. Johnson Books, Boulder, CO. 164 pp.
- Halfpenny, J.C., R.W. Thompson, S.C. Morse, T. Holden, and P. Rezendes. 1995. Chapter 5: Snow tracking. Pages 91-163 in Zielinski, W.J. and T.E. Kucera, tech. eds. American marten, fisher, lynx, and wolverine: survey methods for their detection. Gen. Tech. Rep. PSW-GTR-157. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Dept. Agric. 163 pp.
- Hall, E.R. 1981. Mammals of North America. John Wiley and Sons, New York.
- Hammerson, G.A. 1999. Amphibians and reptiles in Colorado. Univ. Press of Colorado and Colo. Div. Wildl. Niwot, CO. 484 pp.
- Hansen, R.M. and J.T. Flinders. 1969. Food habits of North American hares. Sci. Ser., Range Sci. Dept., Colorado State Univ. 1:1-18.
- Harris, L.D. and P.B. Gallagher. 1989. New initiatives for wildlife conservation: the need for movement corridors. Pages 11-34 In G. Mackintosh, ed. Preserving communities and corridors. Defenders of Wildl., Washington, D.C. 96 pp.
- Hash, H.S. 1987. Wolverine. Pages 575-585 in Novak, M., J.A. Baker, M.E. Obbard, and B. Malloch, eds. Wild furbearer management and conservation in North America. Ontario Min. Nat. Resourc. Ashton-Potter Ltd. Ontario. 1150 pp.
- Hatler, D.F. 1989. A wolverine management strategy for British Columbia. British Columbia Min. Environ. Wildl. Bull. No. B-60. 124 pp.

- Hayward, G.D. and J. Verner, tech. eds. 1994. Flammulated, boreal, and great gray owl in the United States: a technical conservation assessment. Gen. Tech. Rep. RM-253. USDA For. Serv. Rocky Mountain Range and Exper. Stn., Ft. Collins, CO. 214 pp. 3 maps.
- Hayward, G.D., N.M. Warren, B. Parrish, M. Williams, C. Liggett, and V. Starostka. 2004. Region 2 Management Indicator Species Selection Process and Criteria – May 2004. Updated report of the USDA Forest Service. Region 2 Regional Desk Guide, App. G. Revision Analysis Requirements for Planning Docs. June 10. 13 pp.
- Healy, B.D. 2006. Development of and index of sedimentation using macroinvertebrate communities, for streams on the White River National Forest. Unpubl. rep. Holy Cross Ranger District, White River National Forest. Minturn, Colorado.
- Heavner, R. 1997. Personal Communication with Specialist from USEPA, Air Quality Division.
- Henein, K. and G. Merriam. 1990. The elements of connectivity where corridor quality is variable. *Landscape Ecol.* 4:157-170.
- Hennessy, S. P. 1978. Ecological relationships of Accipiters in northern Utah with special emphasis on the effects of human disturbance. Logan, UT. M.S. Thesis, Utah State Univ. 66 pp. (as cited in Rhea et al. 2006)
- Hirsch, C. 2008. Draft five year [WRNF aquatic] monitoring report. White River National Forest, Glenwood Springs. CO. Oct. 10. 4 pp.
- Hirsch, C. 2009. Supplemental information report for the Vail Resort Master Development Plan Phase 1 Projects, White River National Forest, Holy Cross Ranger District, Eagle County, Colorado. White River National Forest, Glenwood Springs. CO. Nov. 10. 5pp.
- Hirsch, C., B. Healy, and C. Myers. 2004. North Barton Gulch. (Unpubl. aquatic MIS monitoring report), White River National Forest, Glenwood Springs. CO. 4 pp.
- Hirsch, C., S.E. Albeke, and T.P. Nesler. 2006. Range-wide status of Colorado River cutthroat trout (*Oncorhynchus clarkii pleuriticus*). Colorado River Cutthroat Trout Conservation Team Report. Craig, Colorado.
- Hoak, J.H., J.L. Weaver, and T.W. Clark. 1982. Wolverines in western Wyoming. *Northwest Sci.* 56:159-161.
- Hodges, K.E. 1999. Ecology of snowshoe hares in southern boreal and montane forests. Chap. 7 in Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, et al. tech. eds. Ecology and conservation of lynx in the United States. Univ. Press of Colorado, Boulder. 480 pp.
- Hoover, R.L. and D.L. Wills, eds. 1984. Managing forested lands for wildlife. Colorado Div. Wildlife in coop. with USDA Forest Service, Rocky Mtn. Reg. Denver, CO. 459 pp.
- Hornocker, M.G. and H.S. Hash. 1981. Ecology of the wolverine in northwestern Montana. *Can J. Zool.* 59:1286-1301.
- Hugie, R.D., T.J. Deliberto, R.S. Martin, E.V. Davies, and M.E. Petersen. 1996. Biological evaluation for the proposed Vail Ski Area Category III development. Pioneer Environ. Serv. Logan, UT. 52 pp.

- Hutto, R.L. 1995. USFS northern region songbird monitoring program: distribution and habitat relationships. Admin. Rep. USFS Region 1. Missoula, MT.
- Hutto, R.L. and J.S. Young. 1999. Habitat relationships of landbirds in the northern region, USDA Forest Service. Gen. Tech. Rep. RMRS-GTR-32. Ogden, UT. USDA Forest Service Rocky Mtn. Res. Stn. 72 pp.
- Intergovernmental Panel on Climate Change (IPCC). 2007. Climate change 2007: impacts, adaptation, and vulnerability. Cambridge Univ. Press. Cambridge, UK.
- Imhoff, M. 2011. Personal communication with Vail Valley Foundation. August 5.
- Jessup, B. and J. Gerritsen. 2000. Stream macroinvertebrate index. Pages. 28-70. In Grafe, C. S. (ed.). Idaho Small Stream Ecological Assessment Framework: An Integrated Approach. Idaho Department of Environmental Quality, Boise, ID.
- Johnson, G. 2011. Personal communication with Beaver Creek Race Department. August 3.
- Johnston, B.C. 1987. Plant Associations of Region Two. USDA Forest Service Report R2-ECOL-87-2, Lakewood, Colorado. 497 pp.
- Jones, S.L. 1998. Olive-sided flycatcher. Pages 268-269 In Kingery, H.E., ed. Colorado breeding bird atlas. Colorado Bird Atlas Partnership. Denver, CO. 636 pp.
- Keinath, D. and M. McGee. 2005. Boreal Toad (*Bufo boreas boreas*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. May 25. Available: <http://www.fs.fed.us/r2/projects/scp/assessments/borealtoad.pdf> [accessed Oct. 31, 2011].
- Kennedy, P.A. and D.W. Stahlecker. 1991. Broadcast calls of the northern goshawk: their effectiveness and their use in inventory and long-term monitoring programs. Eagle Environmental, Inc. Santa Fe, NM. Unpubl. Man. 24 pp.
- Kenvin, D. 1992. Wolverine study results. Internal unpubl. data. CDOW, Monte Vista, CO.
- . 1993. Wolverine study results. Internal unpubl. data. CDOW, Monte Vista, CO.
- . 1994. Wolverine study results. Internal unpubl. data. CDOW, Monte Vista, CO.
- . 1995. Wolverine study results. Internal unpubl. data. CDOW, Monte Vista, CO.
- Kieth, L.B. 1963. Wildlife's ten-year cycle. Univ. Wisconsin Press, Madison. 201 pp.
- Kingery, H., ed. 1998. Colorado breeding bird atlas. Colorado Bird Atlas Partnership. Denver, CO. 636 pp.
- Klenner, W. and D. Huggard. 1997. Three-toed woodpecker nesting and foraging at Sicamous Creek. Pages 224-233 in C. Hollstedt and A. Vyse, eds. Sicamous Creek Silvicultural Systems Project: Workshop Proceedings. April 24-25 1996, Kamloops, British Columbia, Canada. Res. Br., British Columbia Ministry of Forests, Victoria, British Columbia, Canada. Work Pap. 24/1997 (as cited in Wiggans 2004).
- Knight, R.L and D.N. Cole. 1995. Wildlife responses to recreationists. Pages 51-70 in R.L Knight and K.J. Gutzwiller, eds. Wildlife and recreationists: coexistence through- management and research. Island Press, Wash. D.C.

- Knowles, N., M.D. Dettinger, and D.R. Cayan. 2006. Trends in snowfall versus rainfall in the western United States. *J. Climate*. 19:4545-4559.
- Koehler, G.M. and M.G. Hornocker. 1977. Fire effects on marten habitat in the Selway-Bitterroot Wilderness. *J. Wildl. Manage.* 41:500-505.
- Koehler, G.M. and K.B. Aubry. 1994. Lynx. Pages 74-98 in Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, L.J. Lyon, and W.J. Zielinski, tech. eds. *The Scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States*. Gen. Tech. Rep. RM-254. USDA For. Serv. Rocky Mountain Range and Exper. Stn., Ft. Collins, CO. 184 pp.
- Koplin, J.R. 1969. The numerical response of woodpeckers to insect prey in a subalpine forest in Colorado. *Condor* 71:436-438.
- Kotliar, N.B. and C.P. Melcher. 1997. Habitat selection and nesting success of olive-sided flycatchers under natural and managed disturbance regimes. U.S.G.S. Biol. Resour. Div. Unpubl. Man. 20 pp.
- Krott, P. 1960. Ways of the wolverine. *Nat. Hist.* 69:16-29.
- LSC Transportation Consultants, Inc. 2003. Intermountain TPR Transit Element Final Report.
- Ladyman, J.A.R. 2006. *Rubus arcticus* L. ssp. *acaulis* (Michaux) Focke (dwarf raspberry): a technical conservation assessment. JnJ Associates, LLC, Centennial, CO. Oct. 18. 77pp. [Online]. USDA Forest Service, Rocky Mountain Region. Available: <http://www.fs.fed.us/r2/projects/scp/assessments/rubusarcticusspacaulis.pdf>.
- Langlois, D. 1978. Colorado River cutthroat trout, *Salmo clarki pleuriticus* Cope. Pages 11-13 in *Essential habitat for threatened or endangered wildlife in Colorado*. CDOW, Denver. 84 pp.
- Lechleitner, R.R. 1969. Wild mammals of Colorado: their appearance, habitats, distribution, and abundance. Pruett Publ. Co. Boulder, CO. 254 pp.
- Leukering, T, D. Faulkner, R. Levad, and A. Panjabi. 2001. Monitoring Colorado's birds, the year 2000 final report. Unpublished Report. Rocky Mountain Bird Observatory, 14500 Lark Bunting Lane, Brighton, CO, 80601.
- Levad, R. 1998. Peregrine falcon. Pages 128-129 In Kingery, H., ed. *Colorado breeding bird atlas*. Colorado Bird Atlas Partnership. Denver, CO. 636 pp.
- Litvaitis, J.A., J.A. Sherburne, and J.A. Bissonette. 1985. Influence of understory characteristics on snowshoe hare habitat use and density. *J. Wildl. Manage.* 49:866-873.
- Loeffler, C. (ed.) 1998. Conservation plan and agreement for the management and recovery of the Southern Rocky Mountain population of the boreal toad (*Bufo boreas boreas*). Boreal Toad Recovery Team. 66 pp. + appendices.
- Long, J.C. 1965. Native orchids of Colorado. *Denver Mus. of Nat. History*, Denver, CO. Mus. Pict. No. 16. 37 pp.
- Longcore, J.E., A.P. Pessier and D.K. Nichols. 1999. *Batrachochytrium dendrobatidis* gen. et sp. nov., a chytrid pathogenic to amphibians. *Mycologia* 91:219-227.
- Lyon, L.J. 1979. Habitat effectiveness for elk as influenced by roads and cover. *J. Forestry*. 77:658-660.

- . 1983. Road density models describing habitat effectiveness for elk. *J. Forestry*. 81:592-595.
- Lyon, L.J. and C. E. Jensen. 1980. Management implications of elk and deer use of clear-cuts in Montana. *J. Wildl. Manage.* 44:352-361.
- MacArthur, R.A., V. Geist, and R.H. Johnston. 1982. Cardiac and behavioral responses of mountain sheep to human disturbance. *J. Wildl. Manage.* 46:351-358.
- Mack, C.M. 1985. River otter restoration in Grand County, Colorado. Unpubl. M.S. thesis, Colorado State Univ., Ft. Collins, 133 pp. (as cited in Fitzgerald et al. 1994)
- Magoun, A.J. 1985. Population characteristics, ecology, and management of wolverines in northwestern Alaska. Ph.D. Thesis, Univ. Alaska, Fairbanks. 211 pp. (as cited in Hash 1987)
- Martin, S.K. 1994. Feeding ecology of American martens and fishers. Pages 297-315 in Martens, sables and fishers: biology and conservation. S.W. Buskirk, A.S. Harestad, M.G. Raphael and R.A. Powell, eds. Cornell Univ. Press, Ithaca, NY.
- McMullen, B. 2011. Personal Communication with USFS WRNF Soil Scientist. June 16.
- Mech, L.D. 1977. Record movement of a Canadian lynx. *J. Mammal.* 58:676-677.
- Melquist, W.E. and M.G. Hornocker. 1979. Methods and techniques for studying and censusing river otter populations. Tech. Rep. Univ. Idaho For., Wildl. and Range Exper. Sta. 1:1-17. (as cited in Fitzgerald et al. 1994)
- . 1983. Ecology of river otters in west central Idaho. *Wildl. Monogr.* 83:1-60.
- McGuire, D.L. 1999. Clark Fork River macroinvertebrate community biointegrity: 1997 and 1998 assessments. Prepared for Montana Department of Environmental Quality, Planning, Prevention and Assistance Division. Helena, Montana. 70pp. plus appendices.
- Morrison, J.R., W.J. de Vergie, A.W. Alldredge, A.E. Byrne, and W.A. Andree. 1995. The effects of ski area expansion on elk. *Wildl. Soc. Bull.* 23:481-489.
- Moser, D.A. 1962. The bighorn sheep of Colorado. Tech. Publ., Colorado Game and Fish Dept., Denver. 10:1-49.
- Mowat, G., K.G. Poole, and M. O'Donoghue. 2000. Ecology of lynx in northern Canada and Alaska. Chap. 9 in Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, et al. tech. eds. Ecology and conservation of lynx in the United States. Univ. Press of Colorado, Boulder. 480 pp.
- Muths, E. 2003. Home range and movements of boreal toads in undisturbed habitat. *Copeia*. 2003:160-165.
- National Ski Areas Association. 2011. 2010/2011 Kottke National End of Season Survey.
- NatureServe. 2007. NatureServe Explorer: An online encyclopedia of life [web application]. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>.
- Nead, D.M., J.C. Halfpenny and S. Bissell. 1985. The status of wolverines in Colorado. *Northwest Sci.* 58:286-289.

- Nellis, C.H. and L.B. Kieth. 1968. Hunting activities and success of lynxes in Alberta. *J. Wildl. Manage.* 32:718-722.
- Nellis, C.H. and S.P. Wetmore. 1969. Long-range movement of lynx in Alberta. *J. Mammal.* 50:640.
- Nordstrom, L.H. 1998. Endangered and threatened wildlife and plants: proposal to list the contiguous United States distinct population segment of the Canada lynx; proposed rule. *Fed. Register* 63(130):36993-37013.
- Noss, R.F. 1983. A regional landscape approach to maintain diversity. *Bioscience* 33:700-706.
- Osmundson, D.B. and L.R. Kaeding. 1989. Studies of Colorado squawfish and razorback sucker use of the "15 mile" reach of the upper Colorado River as part of Conservation measures for the Green Mountain and Ruedi Reservoir water sales. Final Report. USFWS, Grand Junction, Colorado.
- . 1991. Flow recommendations for maintenance and enhancement of rare fish habitat in the "15 mile" reach during October-June. Final Report. USFWS, Grand Junction, Colorado.
- Overton et al. 1997. R1/R4 Fish and Fish Habitat Standard Inventory Procedures Handbook. C. Kerry Overton, Sherry P. Wollrab, Bruce C. Roberts, Michael A. Radko. USDA FS Intermountain Research Station. General Technical Report INT-GTR-346. May.
- Palmer, D.A. 1984. Current status of the boreal owl in Colorado. *C.F.O. Journal* 18:62 (abstract only).
- Pankratz, H. 2009. Wolverine trots out rare hike into Colorado. *Denver Post*. Denver, CO. June 19.
- Parker, G.R., J.W. Maxwell, and L.D. Morton. 1983. The ecology of lynx (*Lynx canadensis*) on Cape Breton Island. *Can. J. Zool.* 61:770-786.
- Parks, C.G., E.L. Bull, and T.R. Torgerson. 1997. Field guide for the identification of snags and logs in the interior Columbia River Basin. Gen. Tech. Rep. PNW-GTR-390. Portland, OR: U.S. Dept. Agricul., For. Serv., Pacific Northwest Res. Stn. 40 pp.
- Pettus, D. and R.R. Lechleitner. 1963. Microsorex in Colorado. *J. Mammal.* 44:119.
- Phillips, G.E. 1998. Effects of human-induced disturbance during calving season on reproductive success of elk in the upper Eagle River Valley, Colorado. PhD. Diss. Colorado State Univ. Ft. Collins, CO. 101 pp.
- Phillips, G.E. and A.W. Alldredge. 2000. Reproductive success of elk following disturbance by humans during calving season. *J. Wildl. Manage.* 64:521-530.
- Pilliod, D.S., E. Muths, R.D. Scherer, P.E. Bartelt, P.S. Corn, B.R. Hossack, B.A. Lambert, R. Mccaffery, and C. Gaughan. 2009. Effects of amphibian chytrid fungus on individual survival probability in wild boreal toads. *Cons. Bio.*, Vol. 24(5): 1259–1267.
- Pub. L. 110–140 Energy Independence and Security Act of 2007.
- Poole, K.G. 1997. Dispersal patterns of lynx in the Northwest Territories. *J. Wildl. Manage.* 61:497-505.
- RRC Associates. 2001. The Economic Impact of the 1999 World Alpine Ski Championships. June.
- Reed, D.F., T.N. Woodard, and T.M. Pojar. 1975. Behavioral response of mule deer to a highway underpass. *J. Wildl. Manage.* 39:361-367.

- Rees, D.E., J.A. Ptacek, and W.J. Miller. 2005. Roundtail chub (*Gila robusta robusta*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: <http://www.fs.fed.us/r2/projects/scp/assessments/roundtailchub.pdf> [Apr. 13, 2011].
- Reid and Ziemer. 1994. Evaluating the Biological Significance of Intermittent Streams. In Issues in Watershed Analysis. Discussions at Interdisciplinary and Interagency Workshops Held at the Humboldt Interagency Watershed Analysis Center in McKinleyville, California, edited by L. M. Reid: USDA Forest Service, Pacific Southwest Research Station.
- Reynolds, R.T., R.T. Graham, M.H. Reiser, R.L. Bassett, P.L. Kennedy, D.A. Boyce, G. Goodwin, R. Smith, and E.L. Fisher. 1992. Management recommendations for the northern goshawk in the southwestern United States. USDA-FS, Rocky Mtn. For. Range Exp. Stn. Ft. Collins, CO. Gen. Tech. Rep. RM-217. 90 pp.
- Rhea, B., G. Vos, R. Ghormley and T. Harris. 2006. Northern goshawk species assessment, San Juan National Forest. USDA Forest Service. San Juan National Forest. Feb. 19 pp.
- Roe, N.A., K.G. Poole, and D.L. Day. 2000. A review of lynx behaviour and ecology and its application to ski area planning and management. Final Rep. Iris Environmental Systems, Calgary, Alberta. 63 pp.
- Rosenberg, D.K., B.R. Noon and E.C. Meslow. 1997. Biological corridors: form, function, and efficacy. *Biosci.* 47:677-687.
- Rowland, M.M., M.J. Wisdom, B.K. Johnson and J.G. Kie. 2000. Elk distribution and modeling in relation to roads. *J. Wildl. Manage.* 64:672-684.
- Roy, G., S. Kelso, and A. Tonnesen. 1993. Habitat characteristics of *Eutrema penlandii* (Brassicaceae) in the Colorado Rockies: a study in endemism. *Madroño*, Vol. 40 No. 4:236-245.
- Ruediger, W. 1996. The relationship between rare carnivores and highways. Pp. 46-66 in Proceedings of the Florida Department of Transportation/ Federal Highway Administration Transportation-Related Wildlife Mortality Seminar. G. Evink, D. Ziegler, P. Garrett and J. Berry, eds.
- Ruediger, B., J. Claar, S. Gniadek, B. Holt, L. Lewis, S. Mighton, B. Naney, G. Patton, T. Rinaldi, J. Trick, A. Vandehey, F. Wahl, N. Warren, D. Wenger, and A. Williamson. 2000. Canada lynx conservation assessment and strategy. USDA For. Serv., USDI Fish & Wildl. Serv., USDI Bur. Land. Manage. and USDI Nat'l. Park Serv. FS Publ. #R1-00-53. Missoula, MT. 142 pp.
- Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, G.M. Koehler, C.J. Krebs, K.S. McKelvey and J.R. Squires. 1999. Ecology and conservation of lynx in the United States. Univ. Colorado Press and USDA Rocky Mtn. Res. Stn., USDA Gen. Tech. Rep. RMRS-GTR-30WWW. 480pp.
- Ryder, R.A., D.A. Palmer, and J.J. Rawinski. 1987. Distribution and status of the boreal owl in Colorado. Pages 169-174 in Nero, R.W. et al., eds. Biology and conservation of northern forest owls: symposium proceedings. Gen. Tech. Rep. RM-142. USDA Forest Service, Rocky Mtn. For. Range Exp. Stn., Fort Collins, CO.
- Ryder, R.A. 1991. Distribution and status of the boreal owl in western North America: an update. *J. Colorado-Wyoming Acad. Sci.* 23:26.
- Saunders, J.K. 1963. Movements and activities of the lynx in Newfoundland. *J. Wildl. Manage.* 27:390-400.

- Schultz, R.D. and J.A. Bailey. 1978. Responses of National Park elk to human activity. *J. Wildl. Manage.* 42:91-100.
- Scott, V.E., G.L. Crouch, and A.J. Whelan. 1982. Responses of birds and small mammals to clearcutting in a subalpine forest in central Colorado. U.S.D.A. For. Serv. Res. Note RM-422. Ft. Collins, CO. 6 pp.
- Seidel, J.W. 1977. Elk calving behavior in west central Colorado. Pages 38-40, in *Proc. Western States Elk Workshop*, Colorado Div. of Wildl., Denver, CO. 64 pp.
- Seidel, J., B. Andree, S. Berlinger, K. Buell, G. Byrne, B. Gill, D. Kenvin, and D. Reed. 1998. Draft strategy for the conservation and reestablishment of lynx and wolverine in the southern Rocky Mountains. Colorado Div. Wildl., U.S. For. Serv., National Park Serv., U.S. Fish and Wildl. Serv., New Mexico Game and Fish Dept., and Wyoming Game and Fish Dept. Denver, CO. 115 pp.
- Seidl, A. 1993. Final report on the Uncompahgre fritillary butterfly. Unpubl. Rept. Prepared for USFS, in USFWS files, Denver, CO. 48 pp.
- Shenk, T. 2005. General locations of lynx (*Lynx canadensis*) reintroduced to southwestern Colorado from February 4, 1999 through February 1, 2005. Colorado Division of Wildlife, Ft. Collins, CO. 12 pp. April.
- . 2006. Lynx update, March 12, 2006. CDOW, Denver. 3 pp. (http://wildlife.state.co.us/species_cons/lynx.asp)
- . 2007a. Post release monitoring of lynx reintroduced to Colorado. CDOW, Denver. June. 57 pp.
- . 2007b. Lynx (*Lynx canadensis*) use summary for the Ginn Company Battle Mountain Habitat Conservation Plan. Colorado Division of Wildlife, Ft. Collins, CO. 13 pp. June.
- Shuster, W.C. 1976. Northern goshawk nesting densities in montane Colorado. *West. Birds* 7:108-110.
- . 1980. Northern goshawk nest requirements in the Colorado Rockies. *West. Birds* 11:89-96.
- Siemers, J.L. 2009. Pygmy shrew (*Sorex hoyi*) survey on the White River National Forest. Colorado Natural Heritage Program, Fort Collins, CO. 19 pp.
- Slough, B.G. and G. Mowat. 1996. Lynx population dynamics in an untrapped refugium. *J. Wildl. Manage.* 60:946-961.
- Soutiere, E.C. 1979. Effects of timber harvesting on marten in Maine. *J. Wildl. Manage.* 43:850-860.
- Spackman, S.B., B. Jennings, J. Coles, C. Dawson., M. Minton, A. Kratz, and C. Spurrier. 1997. Colorado rare plant field guide. Prepared for Bur. Land Manage., U.S. Forest Serv., and U.S. Fish and Wildl. Serv. Colorado Nat. Heritage. Progr.
- Spencer, A.W. and D. Pettus. 1966. Habitat preferences of five sympatric species of long-tailed shrews. *Ecology*. 47:677-683.
- Spencer, W.D. 1987. Seasonal rest-site preferences of pine martens in the northern Sierra Nevada. *J. Wildl. Manage.* 51:616-621.

- Squires, J. and E. Roberts. 2009. The effects of winter recreation on the movements and resource use of Canada lynx on the Vail Pass Recreation Area: a pilot study. U.S. Forest Service. Rocky Mountain Research Station, Missoula, MT. Nov. 19 pp.
- Stalecker, D.W. and J.J. Rawinski. 1990. First records for the boreal owl in New Mexico. *Condor* 92:517-519.
- Stebbins, R.C. 1966. A field guide to western reptiles and amphibians. Houghton Mifflin Co., Boston. 279 pp.
- Streeter, R.G. and C.E. Braun. 1968. Occurrence of pine marten, *Martes americana* (Carnivora: Mustelidae) in Colorado alpine areas. *Southwest. Nat.* 13:449-451.
- Stevens, S., C. Callaghan, and R. Owchar. 1996. Wildlife corridors around developed areas of Banff National Park. Rep. Prepared for Parks Canada, Banff, AB. (as cited in Gibeau and Heuer 1996 and Ruediger 1996).
- Strickland, M.A., C.W. Douglas, M. Novak, and N.P. Hunzinger. 1982. Marten. Pages 599-612, in J.A. Chapman and G.A. Feldhamer, eds. *Wild mammals of North America: biology, management, and economics*. Johns Hopkins Univ. Press, Baltimore, MD. 1147 pp.
- Sturm, M., C. Racine, and K. Tape. 2001. Increasing shrub abundance in the Arctic. *Nature*. 411-546.
- Suves, P. 2007. The Economic Impact of a Major Sport Event. Swedish School of Sport and Health Sciences.
- Tanimoto, P.D. 1998. Lynx management assessment and comment to the U.S. Fish and Wildlife Service's proposal to list lynx under the Endangered Species Act of 1973. Unpubl. Rep. Predator Project, Bozeman, Montana. (as cited in USFWS 2006)
- Taylor, P.D., L. Fahrig, K. Henein, and G. Merriam. 1993. Connectivity is a vital element of landscape structure. *Oikos*. 68:571-573.
- Thomas, J.W. ed. 1979. Wildlife habitats in managed forests: the Blue Mountains of Oregon and Washington. U.S. D.A. Forest Service. Agric. Hand. No. 553. 512 pp.
- Thomas, J.W. and D.E. Toweill, eds. 1982. Elk of North America: ecology and management. Stackpole Books, Harrisburg, PA. 698 pp.
- Thomas, J.W., R.G. Anderson, C. Masar, and E.L. Bull. 1979. Snags. Pages 60-77. In: J.W. Thomas, Tech Ed. *Wildlife habitats in managed forests: the Blue Mountains of Oregon and Washington*. USDA For. Ser. Agric. Hand. No. 553. U.S. Gov. Prtg. Offc., Wash., D.C. 512pp.
- Thompson, I.D. and P.W. Colgan. 1987. Numerical responses of martens to a food shortage in northcentral Ontario. *J. Wildl. Manage.* 51:824-835.
- Thompson, R.W. 1981. Ecology of Rocky Mountain goats introduced to the Eagles Nest Wilderness, Colorado, and some factors of geographic variation in the lambing season of bighorn sheep. M.S. Thesis. Univ. Wyoming, Laramie. 359 pp.
- . 1993. Wildlife assessment and mitigation plan for residential development in upper Bachelor Gulch, Strawberry Park, and amendments to the Beaver Creek PUD, Eagle County, Colorado. Western Ecosystems, Inc. Boulder, CO. 22 pp.

- . 1994a. 1992-93 baseline wildlife studies for Vail Ski Area's proposed Category 3 expansion. Western Ecosystems, Inc. Boulder, CO. 113 pp.
- . 1994b. 1994 wildlife baseline studies for Vail Ski Area's proposed Category 3 expansion. Western Ecosystems, Inc. Boulder, CO. 77 pp.
- . 1994c. Wildlife mitigation plan and agreement for the amended Beaver Creek Master Plan. Western Ecosystems, Inc. Boulder, CO. 18 pp.
- . 1995a. Biological Assessment/ Biological Evaluation of Lower Sheephorn Chutes, Beaver Creek Ski Area, Colorado. Western Ecosystems, Inc. Boulder, CO. 22 pp.
- . 1995b. Biological Assessment/ Biological Evaluation of Children's Magic Forest Trail, Beaver Creek Ski Area, Colorado. Western Ecosystems, Inc. Boulder, CO. 20 pp.
- . 1995c. Biological Assessment/ Biological Evaluation of Bitterroot Connector Trail, Beaver Creek Ski Area, Colorado. Western Ecosystems, Inc. Boulder, CO. 21 pp.
- . 1996a. Biological Assessment/ Biological Evaluation of the Rose Bowl Bike Trail, Beaver Creek Ski Area, Colorado. Western Ecosystems, Inc. Boulder, CO. 23 pp.
- . 1996b. Biological Assessment/ Biological Evaluation of the Downhill Race Course, Beaver Creek Ski Area, Colorado. Western Ecosystems, Inc. Boulder, CO. 24 pp.
- . 1996c. Wildlife evaluation of Stickline snowboard park, Beaver Creek Ski Area, Eagle County, Colorado. Western Ecosystems, Inc. 37 pp.
- . 1996d. Baseline small mammal survey of Sheer Terror snowboard trail, Vail Ski Area, Eagle County, Colorado. Western Ecosystems, Inc. Boulder, CO. unpubl. data.
- . 1997a. Preliminary wildlife issues associated with Beaver Creek Ski Area's proposed snowmaking expansion. Western Ecosystems, Inc. Boulder, CO. 17 pp.
- . 1997b. Baseline small mammal survey of Malitos snowboard trail, Beaver Creek Ski Area, Eagle County, Colorado. Western Ecosystems, Inc. Boulder, CO. 25 pp.
- . 1997c. Biological Assessment/ Biological Evaluation of Sheep Horn Escape Trail, Beaver Creek Ski Area, Colorado. Western Ecosystems, Inc. Boulder, CO. 23 pp.
- . 2000. Biological Assessment/Biological Evaluation of upgrading Liberty Wirestar's telecommunications site on Beaver Creek Ski Area. Western Ecosystems, Inc. Boulder, CO. June. 44 pp.
- . 2001a. Biological Evaluation for federally listed threatened, endangered, candidate, and proposed species for the proposed Beaver Creek Ski Area 2001 new summer construction projects, Holy Cross Ranger District, White River National Forest, Eagle County, Colorado Western Ecosystems, Inc. Boulder, CO. June. 10 pp.
- . 2001b. Biological Evaluation for federally listed threatened, endangered, candidate, and proposed species for the proposed Beaver Creek Ski Area 2001 new summer construction projects, Holy Cross Ranger District, White River National Forest, Eagle County, Colorado. 10 pp.

- . 2002a. Biological Assessment for the Mountain Top Borrow Pit (BCST 02-005). Western Ecosystems, Inc. Boulder, CO. Aug. 6. 7 pp.
- . 2002b. Biological Assessment for the Beaver Creek Resort gondola, Holy Cross Ranger District, White River National Forest, Eagle County, Colorado. Western Ecosystems, Inc. Boulder, CO. Sep. 20 pp. (final)
- . 2003a. Biological Assessment for the Beaver Creek Chair 9 replacement, Holy Cross Ranger District, White River National Forest, Eagle County, Colorado. Western Ecosystems, Inc. Boulder, CO.
- . 2003b. Technical ecology report for Copper Mountain trails and facilities improvement plan, Summit County, Colorado. Western Ecosystems, Inc. Boulder, CO. 310 pp.
- . 2003c. Biological Assessment for Copper Mountain Resort's trails and facilities improvement plan, Summit County, Colorado. Western Ecosystems, Inc. Boulder, CO. 147 pp.
- . 2004a. Biological Assessment for the Beano's Trace regrade project, Beaver Creek Ski Area, Holy Cross Ranger District, White River National Forest, Eagle County, Colorado. Western Ecosystems, Inc. Boulder, CO. 24 pp.
- . 2004b. Biological Assessment/ biological evaluation for Chair 11 replacement, Beaver Creek Ski Area, Holy Cross Ranger District, White River National Forest, Eagle County, Colorado. Western Ecosystems, Inc. Boulder, CO. 32 pp.
- . 2005. Biological Assessment, Biological Evaluation, And Management Indicator Species report for upper Latigo trail widening, Beaver Creek Ski Area, Holy Cross Ranger District, White River National Forest, Eagle County, Colorado. Western Ecosystems, Inc. Boulder, CO. 45 pp.
- . 2006. Biological Assessments for Durango Mountain Resort's 2006 Master Development Plan EIS and private base area development. Western Ecosystems, Inc. Boulder, CO. Dec. 31. 230 pp.
- . 2011. Biological Assessment for Beaver Creek Resort's Beaver Creek Mountain Improvements project, White River National Forest, Eagle County, Colorado. Western Ecosystems, Inc. Boulder, CO. (in prep.)
- Thompson, R.W. and D.L. Johnson. 1995. Biotic conditions report for the Confluence PUD, Eagle County, Colorado. Western Ecosystems, Inc. Boulder, CO. 15 pp.
- Thompson, R.W. and J.C. Halfpenny. 1989. Canada lynx presence on Vail Ski Area and proposed expansion areas. Western Ecosystems, Inc. Lafayette, CO. 29 pp.
- Thompson, R.W. and D. Steinmann. 2011. Biological Assessment for Breckenridge Ski Resort's Peak 6 improvements project. Western Ecosystems, Inc. Boulder, CO. (in prep.)
- Thompson, R.W., T.J. Watts, and J.C. Halfpenny. 1992. Wolverine survey in the vicinity of the proposed East Fork Ski Area. Western Ecosystems, Inc. 21 pp.
- Town of Avon. 2010. Comprehensive Annual Financial Report.
- Towry, R.K. 1984. Wildlife habitat requirements. Pages 72-209 in R.L. Hoover and D.L. Wills, eds. Managing forested lands for wildlife. Colorado Div. Wildlife in coop. with USDA Forest Service, Rocky Mtn. Reg. Denver, CO. 459 pp.

- Troendle, C.A. and Leaf, C.F. 1980. Hydrology, An Approach to Water Resources Evaluation of Non-point Silvicultural Sources (WRENSS). EPA60018-80-012, Environmental Research Laboratory, Athens, GA.
- U.S. Bureau of Labor Statistics. 2011. Local Area Unemployment Statistics Map [Data file]. Retrieved from <http://data.bls.gov/map/MapToolServlet?state=08&datatype=unemployment&year=2011&period=M04&survey=la&map=county&seasonal=u>.
- U.S. Bureau of Reclamation. 1988. Green Mountain Reservoir, Colorado water marketing program. Final supplement to the Final Environmental Statement, Colorado – Big Thompson Windy Gap Projects, Colorado. U.S. BOR., Billings, MT.
- . 2005. Bureau of Reclamation, Consumptive use reports. Online: <http://www.usbr.gov/uc/library/envdocs/reports/crs/crsul.html>
- U.S. Census Bureau. 2011. 2010 Census Redistricting Data (Public Law (P.L.) 94-171) Summary File—Eagle County.
- USDA Forest Service. 1976. Environmental analysis report: Beaver Creek winter sports site and year round recreation area. U.S.D.A. For. Serv., Rocky Mtn. Reg., White River Nat'l. For., Holy Cross Ranger Distr.
- . 1984. Land and resource management plan for the White River National Forest (as amended). USDA-FS, WRNF. Glenwood Springs, CO.
- . 1991. Threatened, endangered, and sensitive species of the Intermountain Region. Fish. and Wildl. Manage., Intermtn. Reg. Ogden, UT. (as cited in USFS 1996c)
- . 1993 RMRIS data dictionary. USDA For. Serv. Nov. 29.
- . 1995a. Data definitions for Dillon District RMRIS maps. USDA For. Serv. Dillon Ranger Distr. Silverthorne, CO. Feb. 9.
- . 1995b. White River National Forest Soil and Ecological Land Unit Survey. Holy Cross Area, Colorado. December 1995.
- . 1996. Final Environmental Impact Statement Telluride Ski Area expansion. Grand Mesa, Uncompahgre, Gunnison National Forest. USFS, Delta, CO.
- . 2002a. White River National Forest Land and Resource Management Plan 2002 revision. White River National Forest, Glenwood Springs. CO.
- . 2002b. U.S. Department of Agriculture Forest Service, 2002. White River National Forest, Dillon Ranger District. Copper Mountain Resort Environmental Assessment. Kokomo Lift and Teaching Terrain Improvements. March 2002.
- . 2002c. Land and resource management plan-2002 revision for the White River National Forest. Glenwood Springs. CO.
- . 2002d. Final environmental impact statement, Volume 1, for the White River National Forest land and resource management plan 2002 revision. White River National Forest, Glenwood Springs. CO.

- . 2002e. Final environmental impact statement, Volume 3, for the White River National Forest land and resource management plan 2002 revision (Appendices B-M and P-Q). White River National Forest, Glenwood Springs. CO.
- . 2002f. Final environmental impact statement, Volume 4, for the White River National Forest land and resource management plan 2002 revision (Biological Evaluation). White River National Forest, Glenwood Springs. CO.
- . 2002g. Record of decision for the White River National Forest land and resource management plan-2002 revision. Glenwood Springs. CO. 47 pp.
- . 2002h. Lynx habitat parameters-White River National Forest. Unpubl. Forest Service document, White River National Forest, Glenwood Springs. CO. 3 pp. plus LAU spreadsheet (subject to further revision-last available update 4/22/2007).
- . 2004a. Management indicator species monitoring protocol, White River National Forest, macroinvertebrate species. White River National Forest, Glenwood Springs, CO. 10 pp., May 5.
- . 2004b. Breckenridge Ski Resort Peak 8 Summit Lift and Chair 6 Replacement Environmental Assessment. USDA For. Serv., White River National Forest, Dillon Ranger District, Silverthorne, CO. Nov.
- . 2005a. Decision Notice and Finding of No Significant Impact, Forest Plan Amendment 01-05. White River National Forest, Glenwood Springs, CO. March 2005.
- . 2005b. Breckenridge Ski Resort Peak 8 Summit Lift and Chair 6 Replacement Environmental Assessment, Vol. 2, decision notice, finding of no significant impact, selected alternative map, response to comments, errata, appendices. USDA For. Serv., White River National Forest, Dillon Ranger District, Silverthorne, CO. Apr.
- . 2005c. FSH 2509.25 Watershed Conservation Practices Handbook – Draft Final. September 29, 2005. Region 2, Lakewood, CO.
- . 2005d. Environmental Assessment Management Indicator Species (MIS) Forest Plan Amendment 03 to the Land and Resource Management Plan 2002 revision for the White River National Forest. USDA Forest Service, Glenwood Springs, CO. Nov.
- . 2005e. Draft White River National Forest travel management plan White River National Forest, Glenwood Springs, CO.
- . 2005f. Threatened, endangered, and sensitive plants survey field guide. Rangeland Management Staff, Washington Office. March. 24 pp.
- . 2006a. Forest Service Handbook. Watershed Conservation Practices Handbook
- . 2006b. Record of Decision for Environmental Assessment Management Indicator Species (MIS) Forest Plan Amendment 03 to the Land and Resource Management Plan 2002 revision for the White River National Forest. USDA Forest Service, Glenwood Springs, CO. Mar.
- . 2006c. Decision notice & finding of no significant impact, Forest Plan Amendment 02, alpine and roadless standards and guidelines. USDA Forest Service, White River National Forest, Glenwood Springs, CO. Jan.

- . 2007. Species Conservation Program: Region 2 Regional Forester's Sensitive Species. <http://www.fs.fed.us/r2/projects/scp/sensitivespecies/index.shtml>. Site accessed Oct. 22, 2007.
- . 2008a. Draft White River National Forest aquatic MIS write-up 2008. White River National Forest, Glenwood Springs. CO.
- . 2008b. Supplemental Draft Environmental Impact Statement, White River National Forest Travel Management Plan, Eagle, Garfield, Gunnison, Mesa, Moffat, Pitkin, Rio Blanco, Routt, and Summit Counties, Colorado. White River National Forest, Glenwood Springs. CO. September.
- . 2008c. Biological Assessment for the Beaver Creek Resort's Mountain Improvements Project, White River National Forest, Eagle County, CO.
- . 2008d. Biological Evaluation and Management Indicator Species Report for the Beaver Creek Resort's Mountain Improvements Project, White River National Forest, Eagle County, CO.
- . 2008e. Record of Decision, Southern Rockies Lynx Amendment Management Direction. USDA Forest Service, Rocky Mountain Reg. Denver, CO. Oct.
- . 2009a. White River National Forest revised sensitive species list - terrestrial. USDA Forest Service, Glenwood Springs, CO. May 8.
- . 2009b. Implementation guide to the Southern Rockies Lynx Amendment. USDA Forest Service, Rocky Mountain Reg. Denver, CO.
- . 2010. Beaver Creek Mountain Improvements project scoping notice. USDA Forest Service, White River National Forest, Glenwood Springs. CO. Dec. 3. 7pp.
- . 2011a. White River National Forest Travel Management Plan Final Environmental Impact Statement, Eagle, Garfield, Gunnison, Mesa, Moffat, Pitkin, Rio Blanco, Routt, Summit Counties, Colorado USDA Forest Service, Glenwood Springs, CO. March.
- . 2011b. Record of Decision, White River National Forest Travel Management Plan Final, Eagle, Garfield, Gunnison, Mesa, Moffat, Pitkin, Rio Blanco, Routt, Summit Counties, Colorado USDA Forest Service, Glenwood Springs, CO. March.
- . 2011c. Beaver Creek Forest Health Environmental Assessment. White River National Forest, Glenwood Springs. CO.
- . 2011d. Final Environmental Impact Statement and Record of Decision, White River National Forest Travel Management Plan, Eagle, Garfield, Gunnison, Mesa, Moffat, Pitkin, Rio Blanco, Routt, and Summit Counties, Colorado. White River National Forest, Glenwood Springs. CO. Mar.
- U.S. Environmental Protection Agency. 1996. Biological criteria, technical guidance for streams and small rivers. EPA 822-B-001. Rev. ed. EPA Office of Water.
- . 1999. Consideration of cumulative effects in EPA review of NEPA documents. U.S. EPA Off. Fed. Activities. Wash., D.C. 18 pp.
- . 2010. Inventory of US Greenhouse Gas Emissions and Sinks: 1990–2008.

- U.S. Energy Information Administration. 2009. International Energy Statistics Global CO2 emissions from fossil fuel combustion. <http://tonto.eia.doe.gov/cfapps/ipdbproject/IEDIndex3.cfm>> EIA (2009).
- U.S. Fish and Wildlife Service. 1983. October 19 concurrence letter from Terry J. Hickman, Acting Field Supervisor (USFWS) to Richard Eggen, Environmental Officer (US Bureau of Reclamation) for the proposed Green Mountain Reservoir water exchange between the BR and Town of Breckenridge. USFWS, Salt Lake City, UT. 1 p.
- . 1987. Letter (biological opinion) from Robert Ruesink, USFWS Field Supervisor, to Gary Cargill, USFS Regional Forester. USFWS Grand Jct. CO. April 7. 5pp. (SE/SLC: 6-5-86-F027)
- . 1990a. Humpback Chub Recovery Plan. USFWS, Denver, Colorado. 43pp.
- . 1990b. Bonytail Chub Recovery Plan. USFWS, Denver, Colorado. 35pp.
- . 1991. Colorado Squawfish Recovery Plan. USFWS, Denver, CO. 56pp.
- . 1993. Programmatic biological opinion from John L. Spinks, Jr. Deputy USFWS Regional Director to Elizabeth Estill, USFS Regional Forester. Colorado Field Office, Lakewood, CO. Sep. 7. 27 pp. (FWS/ES/FS/GJ-6 CO-93-F-036 Mail Stop 60120).
- . 1999. Final programmatic biological opinion for Bureau of Reclamation's operations and depletions, other depletions, and funding and recovery program actions in the upper Colorado River above the confluence with the Gunnison River. USFWS Grand Jct. CO.
- . 2000. Endangered and threatened wildlife and plants; determination of threatened status for the contiguous U.S. distinct population segment of the Canada lynx and related rule. Fed. Regist. 65(58):16051-16086.
- . 2006. Endangered and threatened wildlife and plants; designation of critical habitat for the contiguous United States distinct population segment of the Canada lynx. Fed. Regist. 71(217):66008-66061. Nov. 9.
- U.S. Fish and Wildlife Service and National Marine Fisheries Service. 1998. Endangered species consultation handbook: procedures for conducting consultation and conference activities under section 7 of the Endangered Species Act. U.S. Fish and Wildlife Serv. and Nat'l Marine Fisheries Serv. March.
- U.S. Fish and Wildlife Service and U.S. Forest Service. 2001a. Programmatic consultation agreement for Canada lynx in Colorado. Colorado Field Office, Denver, CO. 3 pp.
- . 2001b. SRM lynx project decision tree. Colorado Field Office, Denver, CO.
- . 2004. Colorado lynx project decision screens. Colorado Field Office, Denver, CO. June.
- . Programmatic consultation agreement between U.S. Forest Service and U.S. Fish and Wildlife Service for the Southern Rockies Lynx Project Screens (includes Attach. A – Colorado lynx project decision Screens, Attach. B – USFWS Programmatic Letter of Concurrence). U.S. Forest Service, Denver, CO, U.S. Fish and Wildlife Service, Grand Jct, CO and Cheyenne, WY. Sep. and Oct. 2010.

- U.S. Fish and Wildlife Service, U.S. Forest Service, Bureau of Land Management, and National Park Service. 2010. Inter-agency Southern Rockies lynx project decision screens. Colorado Field Office, Denver, CO. June.
- Urban Land Institute. 2008. Advisory Services Panel Report. Eagle-Vail Colorado.
- Vail Associates. 1994. Amended Beaver Creek Master Plan wildlife mitigation plan, June 15, 1994. 18 pp.
- Vail Resorts. 2007. Vail Resort Master Development Plan Update. August 2007.
- Vail Valley Foundation. 2011. 2015 Summary and Economic Benefits – unpublished.
- Vaughan, T.A. 1969. Reproduction and population densities in a montane small mammal fauna. Pages 51-74 in Jones, J.K., ed. Contributions in mammalogy. Misc. Publ. Mus. Nat. Hist., Univ. Kansas. 51:1-428.
- Ventura, G. 2004. Personal Communication with CDOT Traffic Unit Analysis Manager. June 15.
- Verner, J. 1993. Forest owl inventory protocol (flamulated and boreal owls). USFS Pike and San Isabel National Forests. Pueblo, CO. Unpubl. Man. 7 pp.
- Versaw, A.E. 1998a. American pipit. Pages 410-411 in Kingery, H.E., ed. Colorado breeding bird atlas. Colorado Bird Atlas Partnership. Denver, CO. 636pp.
- . 1998b. Three-toed woodpecker. Pages 264-265 in Kingery, H., ed.; Colorado Breeding Birds Atlas. Denver Mus. Nat. Hist. and Colorado Div. Wildl. Denver, CO. 636 pp.
- Walsh, C. 2004. State Ski Industry a Peak Producer. Rocky Mountain News. April 1.
- Wallis, B., H. Britten, J. Capodice, J. Coles, T. Holland, T. Ireland, and P.A. Opler. 1994. Uncompahgre fritillary butterfly recovery plan. USFWS, Denver, CO 20 pp.
- Ward, J.V., B.C. Kondratieff and R.E. Zuellig. 2002. An illustrated guide to the mountain stream insects of Colorado, second edition. Univ. Press of Colorado. Boulder, CO.
- Ward, R.M.P. and C.J. Krebs. 1985. Behavioral responses of lynx to declining snowshoe hare abundance. Can. Field-Nat. 80:18-23.
- Weaver, R. 2007. Dept. of the Army Permit Application No. SPK-2007-339-GB Eagle Park Reservoir enlargement water depletions. Hydrosphere, Boulder, CO. Aug. 21. 2pp.
- Weaver, R. 2009. Water rights augmentation for snowmaking. AMEC Earth & Environmental, Boulder, CO. Nov. 12. 2pp.
- Webb, B. 1982. Distribution and nesting requirements of montane forest owls in Colorado. Part II: northern pygmy owl (*Glaucidium gnoma*) and boreal owl (*Aegolius funereus*). C.F.O. Journal. 16:58-65.
- Weber, W. A. and R. C. Wittmann. 2001. Colorado Flora: Western Slope (Third Edition). Univ. Press of Colorado. Boulder, Colorado. 488 pp.
- Weinhold, M. 2009. Personal Communication Forest Service Hydrologist.
- . 2011. Personal Communication Forest Service Hydrologist.

- Wiens, J.A. 1997. Metapopulation dynamics and landscape ecology. Pages 43-62 In I. Hanski and M.E. Gilpin. Eds. Metapopulation biology: ecology, genetics, and evolution. Academic Press, San Diego. CA.
- Wiggins, D. 2004. American three-toed woodpecker (*Picoides dorsalis*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Jul. 1. Available: <http://www.fs.fed.us/r2/projects/scp/assessments/americanthreetoedwoodpecker.pdf> [Sep. 24, 2008].
- Wilson, D.E. 1982. Wolverine (*Gulo gulo*). Pages 644-652 In J.A. Chapman and G.A. Feldhamer, eds. Wild mammals of North America: biology, management and economics. Johns Hopkins Press, Baltimore.
- Wilson, K. and S. Ask. 1999. Effect of ski development on small mammal populations: first year report. Colorado State Univ. Ft. Collins. Jan. 23. 4 pp.
- Wilson, K. and G. Hadley. 2000a. Effect of ski run development on small mammal populations: second year report. Colorado State Univ. Ft. Collins. Jan. 3. 6 pp.
- . 2000b. Effect of ski run development on small mammal populations: third year report. Colorado State Univ. Ft. Collins. Nov. 27. 6 pp.
- Wolff, J.O. 1978. Food habitats of snowshoe hares in interior Alaska. J. Wildl. Manage. 42:148-153.
- Woodbridge, B., and C.D. Hargis. 2005. Northern Goshawk Inventory and Monitoring Technical Guide. Northern Goshawk Inventory and Monitoring Design Team. USDA Forest Service, Washington Office, Ecosystem Management Coordination Staff. 63 pp.
- Woodling, J. 1985. Colorado's little fish: a guide to the minnows and other lesser known fishes in the state of Colorado. CDOW Denver, CO. 77 pp.
- Young, M. K. 1995. Conservation assessment for inland cutthroat trout. Gen. Tech. Report RM-256. USDA Forest Service Rocky Mountain Forest and Range Experiment Station. Fort Collins, Colorado. 61 pp.
- . 1996. Summer movements and habitat use by Colorado River cutthroat trout (*Oncorhynchus clarkii pleuriticus*) in small, montane streams. Canadian Journal of fisheries and Aquatic Sciences 53: 1403-1408.
- . 2009. Greenback Cutthroat Trout (*Oncorhynchus clarkii stomias*): a technical conservation assessment. [Online]. USDA Forest Service, Rocky Mountain Region. Available: <http://www.fs.fed.us/r2/projects/scp/assessments/greenbackcutthroattrout.pdf> [Mar. 4, 2010].

Chapter 6

Figures



6. FIGURES

LOCATION MAP

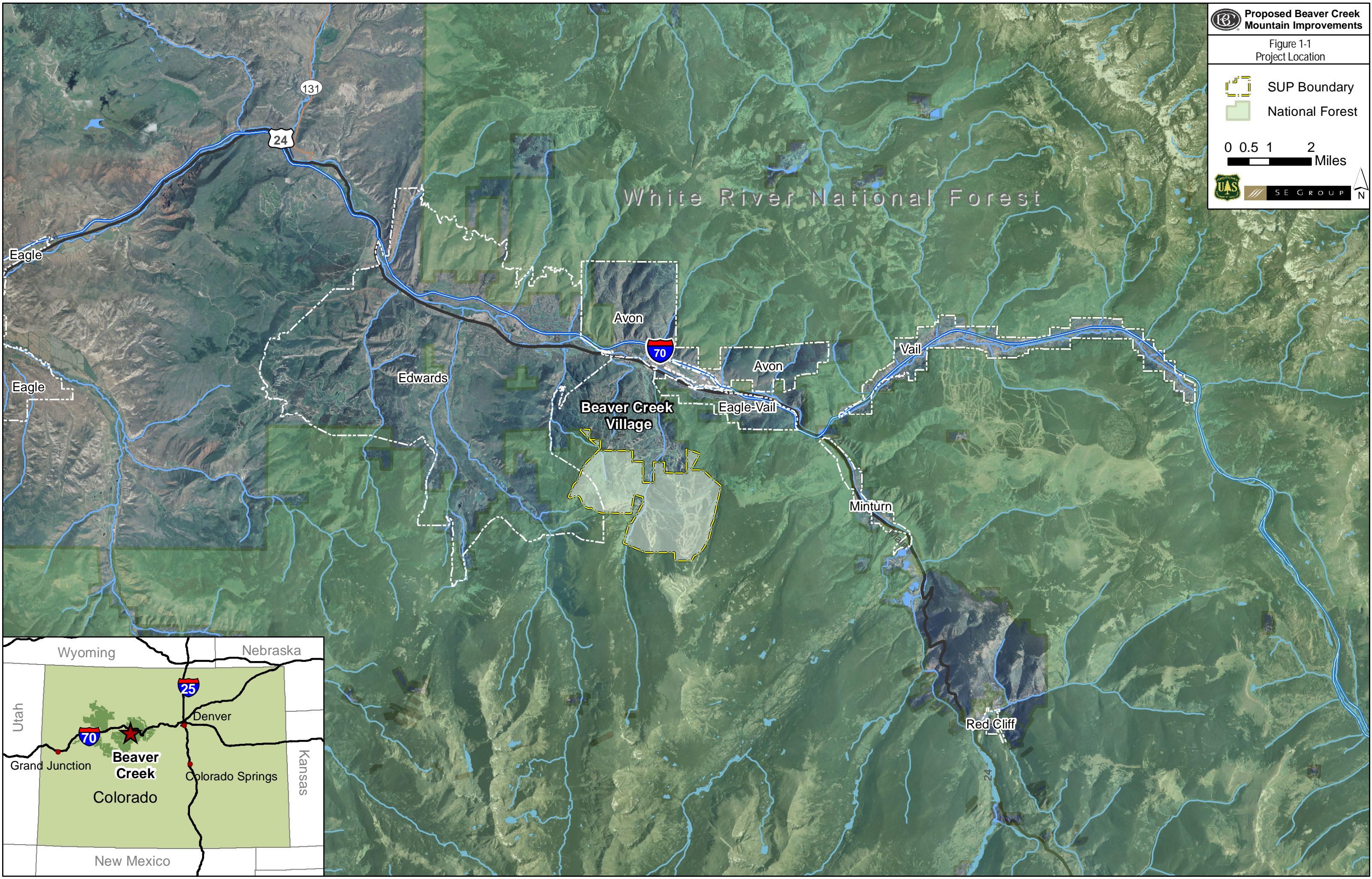
FIGURE 1: ALTERNATIVE 1 – NO ACTION

FIGURE 2: ALTERNATIVE 2 – PROPOSED ACTION

FIGURE 3: WATER RESOURCES

-  SUP Boundary
-  National Forest

0 0.5 1 2 Miles



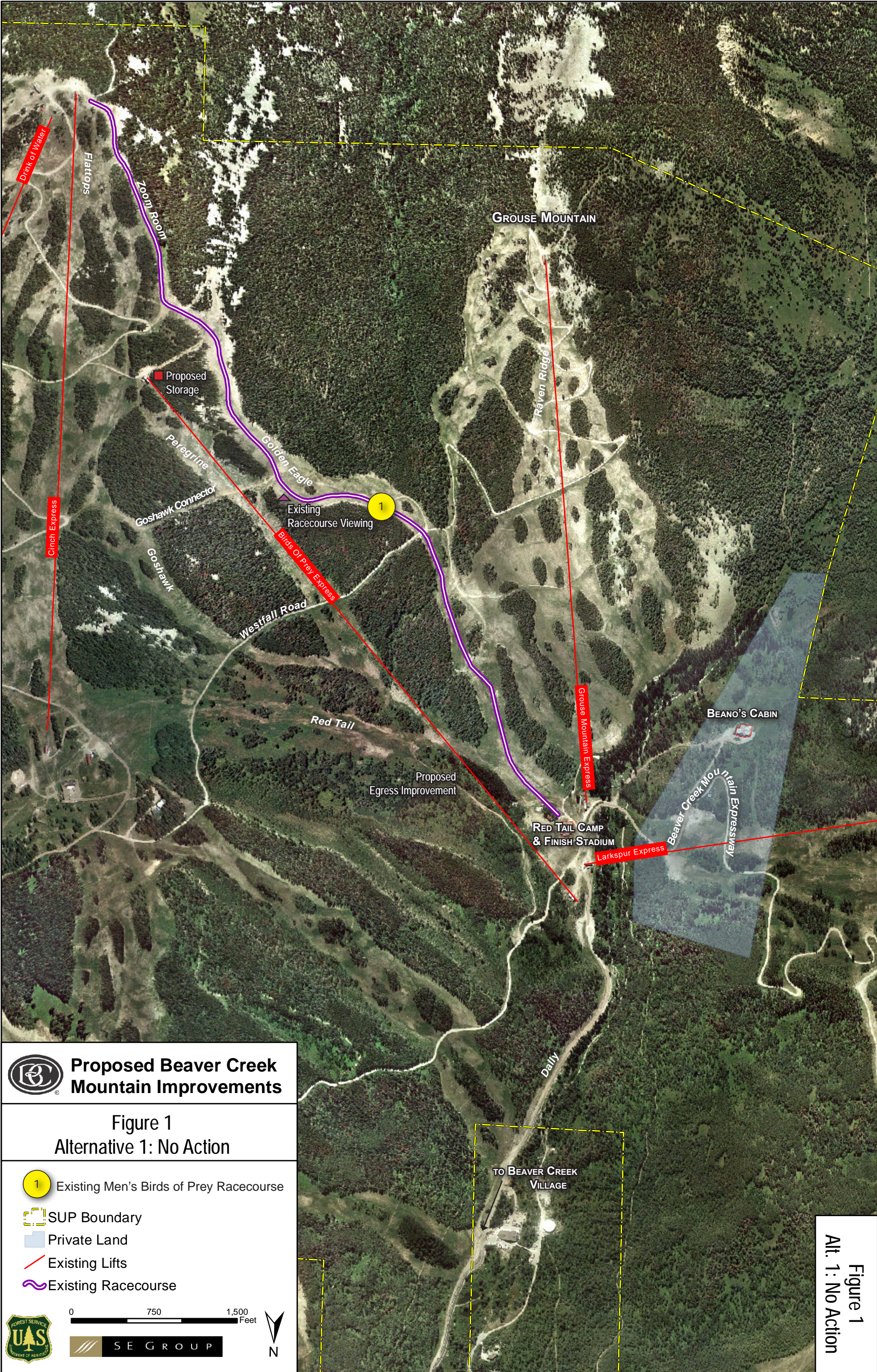
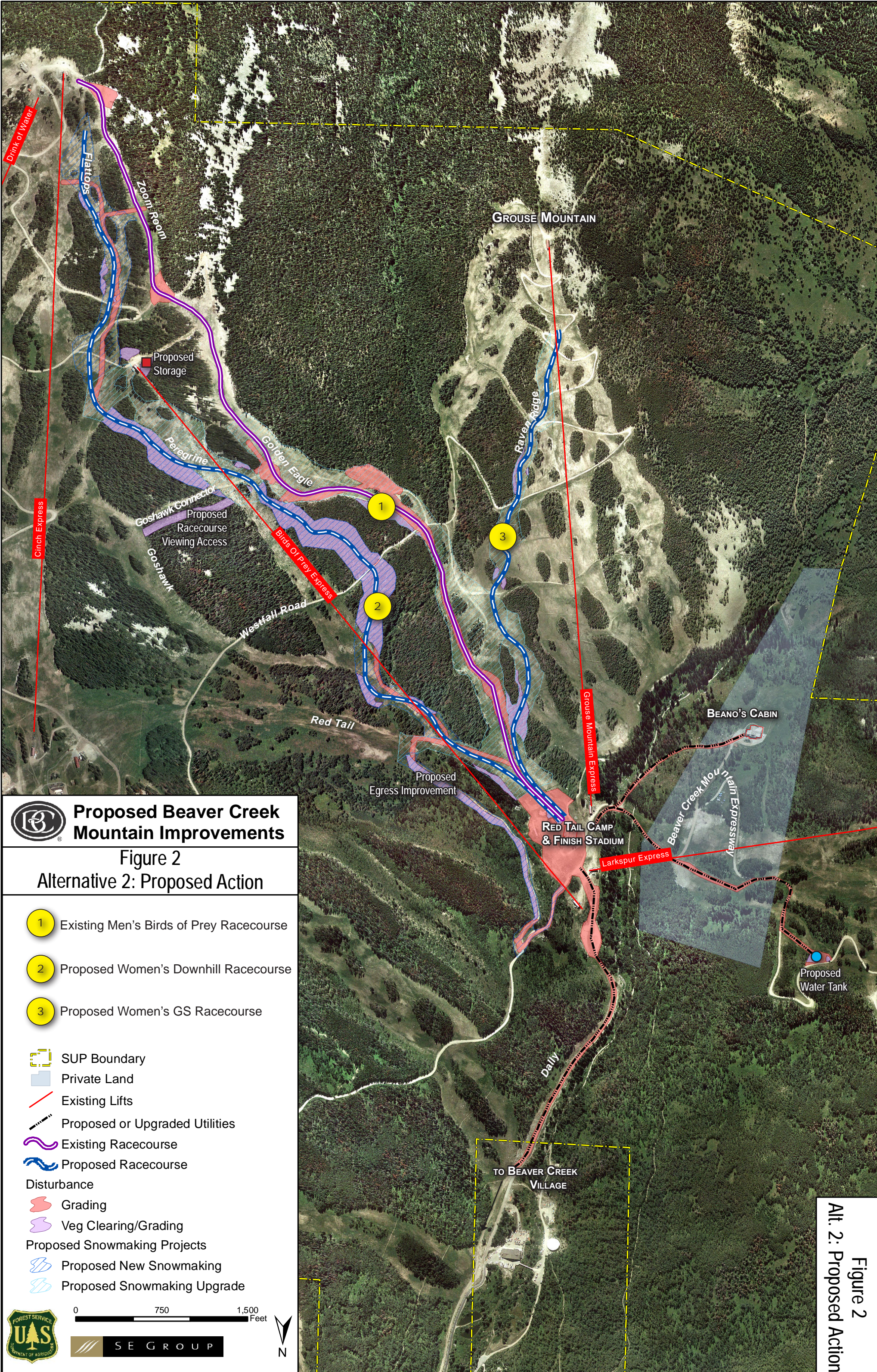


Figure 1
Alt. 1: No Action



Proposed Beaver Creek Mountain Improvements

Figure 2
Alternative 2: Proposed Action

- 1 Existing Men's Birds of Prey Racecourse
- 2 Proposed Women's Downhill Racecourse
- 3 Proposed Women's GS Racecourse

- SUP Boundary
- Private Land
- Existing Lifts
- Proposed or Upgraded Utilities
- Existing Racecourse
- Proposed Racecourse
- Disturbance
 - Grading
 - Veg Clearing/Grading
- Proposed Snowmaking Projects
 - Proposed New Snowmaking
 - Proposed Snowmaking Upgrade

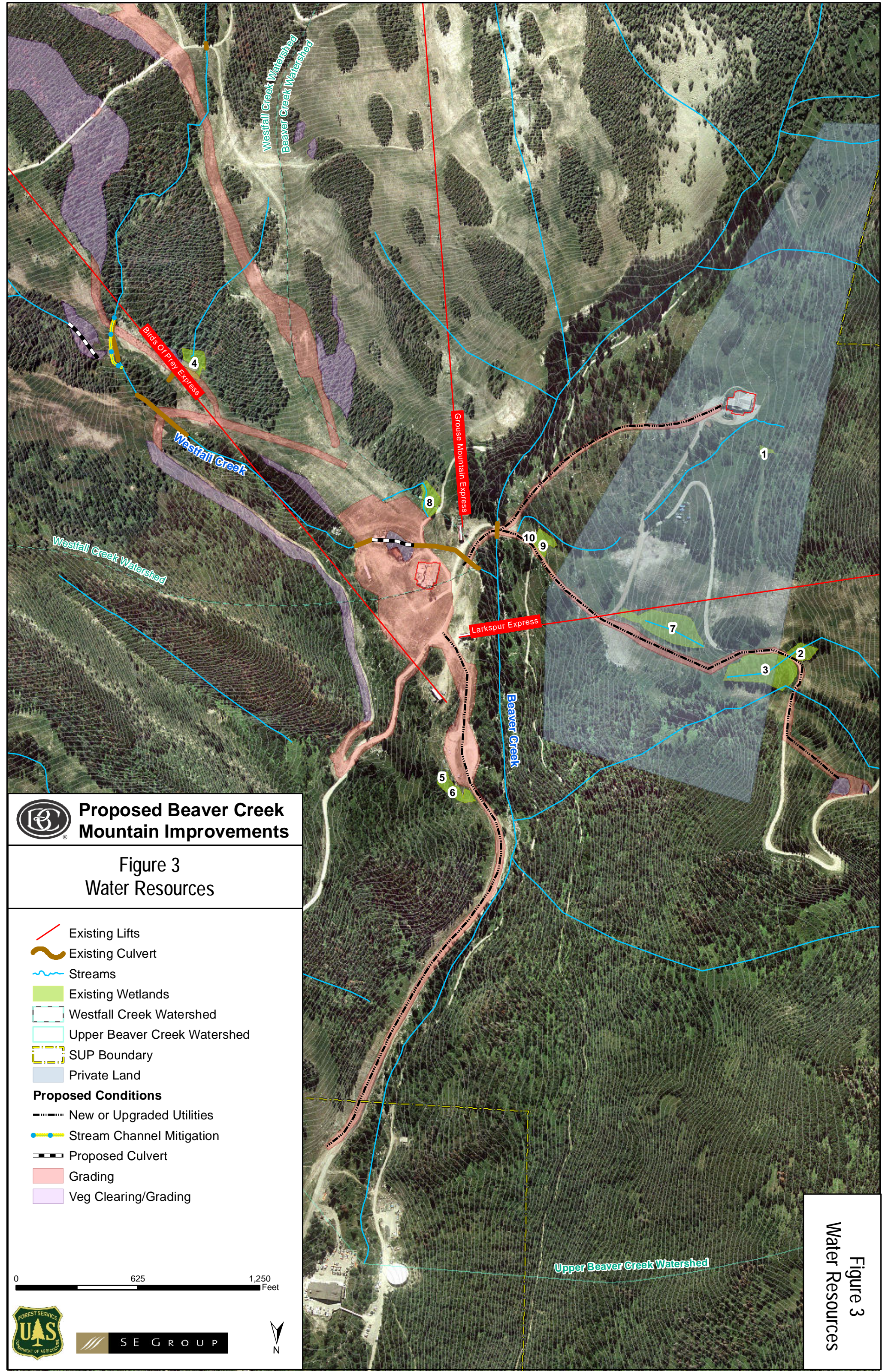


0 750 1,500 Feet

SEG GROUP



Figure 2
Alt. 2: Proposed Action



Proposed Beaver Creek Mountain Improvements

Figure 3
Water Resources

- Existing Lifts
- Existing Culvert
- Streams
- Existing Wetlands
- Westfall Creek Watershed
- Upper Beaver Creek Watershed
- SUP Boundary
- Private Land
- Proposed Conditions**
- New or Upgraded Utilities
- Stream Channel Mitigation
- Proposed Culvert
- Grading
- Veg Clearing/Grading

0 625 1,250 Feet



Figure 3
Water Resources

Chapter 7

Glossary

7. GLOSSARY

Acre foot: The amount of water necessary to cover 1 acre to a depth of 1 foot; equals 43,560 cubic feet or 325,851 gallons.

Action Alternatives: Any alternative that includes upgrading and/or expansion of existing winter and summer recreational development within the area.

Affected environment: The physical, biological, social, and economic environment that would or may be changed by actions proposed and the relationship of people to that environment.

Airshed: A geographical area that, because of topography, meteorology, and climate, shares the same air. The Clean Air Act establishes three air quality classes (I, II, and III), each with defined air quality standards.

Class I airsheds are areas designated for the most stringent degree for protection from future degradation of air quality.

Class II airsheds are areas where a moderate amount of development could occur.

Class III airsheds are areas where significant development could occur as long as National Ambient Air Quality Standards are not exceeded.

Alternative: One of several conceptual development plans described and evaluated in the EIS.

Annual Average Daily Traffic (AADT): Annual average two-way daily traffic volume represents the total traffic on a section of roadway for the year, divided by 365. It includes both weekday and weekend traffic volumes.

Army Corps of Engineers (COE): The federal agency charged with enforcing the Clean Water Act by regulation of dredge and fill activities in waters of the United States, including wetlands.

Average Daily Traffic (ADT): Average daily two-way traffic volume represents the total traffic on a section of roadway for a given day or sampling period, but not necessarily for a given year. It is equivalent to VPD, defined below.

Background view: A landscape viewing area visible to a viewer from approximately 3 to 5 miles to infinity. Also, in economics, naturally occurring; uninduced.

Baseline condition: The existing dynamic conditions prior to development, against which potential effects are judged.

Best Management Practices (BMPs): Forest management actions and mitigation prescriptions, which are designed to maintain resource values through preventative rather than corrective measures.

Biological Evaluation: An evaluation conducted to determine whether a proposed action is likely to affect any species which are listed as sensitive (USFS), candidate (USFS), or other special designations.

Canopy: The more-or-less continuous cover of leaves, needles and/or branches collectively formed by the crowns of adjacent trees in a stand or forest.

CDPHE: Colorado Department of Public Health and Environment. The State of Colorado Department responsible for overseeing water quality regulation within Colorado.

Clean Water Act: An act that was enacted by the U.S. Congress in 1977 to maintain and restore the chemical, physical, and biological integrity of the waters of the United States. This act was formerly known as the Federal Water Pollution Control Act (33 U.S.C. 1344).

Comfortable carrying capacity (CCC): Comfortable Carrying Capacity (CCC) is a planning tool used to determine the optimum level of utilization that facilitates a pleasant recreational experience. This is a planning figure only and does not represent a regulatory cap on visitation. CCC is used to ensure that different aspects of a resort's facilities are designed to work in harmony, that capacities are equivalent across facilities, and sufficient to meet anticipated demand. CCC is based on factors such as vertical transport and trail capacities.

Consumptive use: Use of a resource that reduces the supply.

Corridor: A linear strip of land identified for the present or future location of transportation or utility rights-of-way within its boundaries. Also, a contiguous strip of habitat suitable to facilitate animal dispersal or migration.

Council on Environmental Quality (CEQ): An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.

Cover: Vegetation used by wildlife for protection from predators and weather conditions, or in which to reproduce.

Cover Density: Forest cover density is an index which theoretically ranges from zero to less than one. It references the capability of the stand or cover to integrate and utilize the energy input to transpire water. Cover density represents the efficiency of the three-dimensional canopy system to respond to the energy input. It varies according to crown closure, vertical foliage distribution, species, season, and stocking.

Critical habitat: A formal designation pursuant to the Endangered Species Act which may be applied to a particular habitat that is essential to the life cycle of a given species, and if lost, would adversely affect that species. Critical habitat can have a less formal meaning when used outside the context of the Endangered Species Act.

Cubic feet per second (cfs): Unit measure of streamflow or discharge, equivalent to 449 gallons per minute or about 2 acre feet per day.

Cumulative impact: The impact on the environment which results from the incremental impact of the action when added to other past, present and reasonable foreseeable future actions regardless of what agency or person undertakes such other actions. Each increment from each project may not be noticeable but cumulative impacts may be noticeable when all increments are considered together.

Direct impact: An effect which occurs as a result of an action associated with implementing the proposal or one of the alternatives, including construction, operation, and maintenance.

Distance zone: One of three categories used in the visual management system to divide a view into near and far components. The three categories are (1) foreground, (2) middleground, and (3) background. See individual entries.

Endangered species: An official designation for any species of plant or animal that is in danger of extinction throughout all or a significant portion of its range. An endangered species must be designated in the Federal Register by the appropriate Federal Agency Secretary.

Environmental Assessment (EA): A concise public document required by the regulations implementing the National Environmental Policy Act which briefly provides sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact.

Environmental Impact Statement (EIS): A disclosure document required by the National Environmental Policy Act (NEPA) that documents the anticipated environmental effects of a proposed action that may significantly effect the quality of the human environment.

Environmental Protection Agency (EPA): The federal agency charged with lead enforcement of multiple environmental laws, including review of Environmental Impact Statements.

Erosion: The detachment and movement of soil from the land surface by wind, water, ice, or gravity.

Erosion control: Materials, structure, and techniques designed to reduce erosion. Erosion control may include rapid revegetation, avoiding steep or highly erosive sites, and installation of cross-slope drainage structures.

Finding of No Significant Impact (FONSI): A document that is prepared if the agency finds, in an environmental assessment, that the proposed action will not significantly affect the human environment. It must set forth the reasons for such a decision.

Forage: All browse and non-woody plants used for grazing or harvested for feeding livestock or game animals.

Forb: Any non-grass-like plant having little or no woody material on it. A palatable, broadleaved, flowering herb whose stem, above ground, does not become woody and persistent.

Foreground view: The landscape area visible to an observer from the immediate area to 0.5 mile.

Forest Plan: A comprehensive management plan prepared under the National Forest Management Act of 1976 that provides standards and guidelines for management activities specific to each National Forest. The SJNF Forest Plan was approved in 1992.

Forest Service: The agency of the United States Department of Agriculture responsible for managing National Forests and Grasslands.

Forest Supervisor: The official responsible for administering the National Forest System lands in a Forest Service administrative unit who reports to the Regional Forester.

GIS: Geographic information system, a computer mapping system composed of hardware and software.

GPS: Global Positioning System, a satellite-based surveying system.

Guideline: An indication or outline of policy or conduct that is not a mandatory requirement (as opposed to a standard, which is mandatory).

Habitat type: A classification of the vegetation resource based on dominant growth forms. The forested areas are more specifically classified by the dominant tree species.

Hydric soils: Soils characterized by, or requiring an abundance of moisture, used in the identification of wetlands.

Indirect impact: Secondary consequences to the environment resulting from a direct impact. An example of an indirect impact is the deposition of sediment in a wetland resulting from surface disturbance in the upland.

Instream flow: The volume of surface water in a stream system passing a given point at a given time.

Interdisciplinary Team (ID Team): A group of individuals each representing specialty resource areas assembled to solve a problem or perform a task through frequent interaction so that different disciplines can combine to provide new solutions.

Management direction: A statement of multiple-use and other goals and objectives, the associated management prescriptions, and standards and guidelines for attaining them.

Management indicator species (MIS): A representative group of species that are dependant of a specific habitat type. The health of an indicator species is used to gauge function of the habitat on which it depends.

Management practice: A specific activity, measure, course of action, or treatment.

Master Development Plan (MDP): A document that is required as a condition of the ski area term special use permit, designed to guide resort planning and development and avoid piecemeal decision making.

Middleground view: The landscape area visible to a viewer from 0.5 mile to about 3 to 5 miles.

Mitigation: Actions taken to avoid, minimize, reduce, eliminate, or rectify the adverse environmental impacts associated with the implementation of an alternative or a portion thereof.

National Ambient Air Quality Standards (NAAQS): Established under the Clean Air Act of 1963, there are primary standards, designed to protect public health, and secondary standards, designed to protect public welfare from known or anticipated air pollutants.

National Environmental Policy Act (NEPA): A law enacted by Congress in 1969 that requires federal agencies to analyze the environmental effects of all major federal activities that may have a significant impact on the quality of the human environment.

National Forest Management Act (NFMA): A law passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act that requires the preparation of regulations to guide that development.

National Forest System (NFS) lands: National Forests, National Grasslands, and other related lands for which the Forest Service is assigned administrative responsibility.

National Historic Preservation Act (NHPA): An act that was enacted by the U.S. Congress in 1966 to protect historic sites and artifacts (16 U.S.C. 470). Section 106 of the Act requires consultation with members and representatives of Indian tribes.

National Register of Historic Places: A listing maintained by the National Park Service of areas which have been designated as historically significant. The register includes places of local and state significance, as well as those of value to the nation in general.

No action alternative: The management direction, activities, outputs, and effects that are likely to exist in the future if the current trends and management would continue unchanged. Under NEPA, it means following the current approved Forest Plan management direction and guidance.

Particulates: Small particles suspended in the air and generally considered pollutants.

Pod: The area comprising a lift and associated trails.

Preferred Alternative: The alternative selected from the range of alternatives which is favored by the lead agency.

Project area: The area encompassed by the development proposal including base area and the permit area.

Project Design Features: Specific measures designed to minimize or avoid impacts anticipated to occur as a result of implementation of the action alternatives. Project Design Features (PDF) are required components of specified action alternatives.

Proponent: The individual or business who is proposing the development. In this case, the proponent is Durango Mountain Resort.

Record of Decision (ROD): A document prepared within 30 days after the final EIS is issued which states the agency's decision and why one alternative was favored over another, what factors entered into the agency's decision, and whether all practicable means to avoid or minimize environmental harm have been adopted, and if not, why not.

Revegetation: The re-establishment and development of self-sustaining plant cover. On disturbed sites, this normally requires human assistance such as seedbed preparation, reseeding, and mulching.

Riparian habitat: Land situated along the bank of a stream or other body of water and directly influenced by the presence of water (e.g., streambanks, lake shores, etc).

Scenic Integrity: State of naturalness or, conversely, the state of disturbance created by human activities or alteration. Integrity is stated in degrees of deviation from the existing landscape character in a national forest.

Scenic Integrity Objectives (SIOs): The objectives that define the minimum level to which landscapes are to be managed from an aesthetics standpoint. There are six objectives that describe the landscape in varying degrees from naturalness: Very High (Unaltered), High (Appears Unaltered), Moderate (Slightly Altered), Low (Moderately Altered), Very Low (Heavily Altered).

Scenery Management System: The USDA Forest Service methodology for classifying the aesthetic values of landscapes are based upon the scenic attractiveness of the landscape, the landscape's visibility and the public's concern about changes in the landscape from a natural condition.

Scoping process: A process that determines the issues, concerns, and opportunities which should be considered in analyzing the impacts of a proposal by receiving input from the public and affected agencies. The depths of analysis for these issues identified are determined during scoping.

Sediment: Solid material, both organic and mineral, that has been transported from its site of origin by air, water, or ice.

Sensitive species: Species which have appeared in the Federal Register as proposed additions to the endangered or threatened species list; those which are on an official State list or are recognized by the Regional Forester to need special management in order to prevent them from becoming endangered or threatened.

Special Use Permit (SUP): A legal document, similar to a lease, issued by the U.S. Forest Service. These permits are issued to private individuals or corporations to conduct commercial operations on National Forest System lands. They specify the terms and conditions under which the permitted activity may be conducted.

Special-use permit area: That area of National Forest lands encompassed within the permit boundary held by Durango Mountain Resort and designated for recreational use (e.g., downhill skiing and Nordic skiing). Excludes private land.

Stand: A community of trees or other vegetation, which is sufficiently uniform in composition, constitution, age, spatial arrangement, or condition to be distinguishable from adjacent communities and to thus, form a management entity.

Study area: The geographical area that was analyzed to predict the possible effect that may be associated with proposed alternatives. This area varies depending on the resource, but often coincides with the special use permit boundary.

Threatened species: Any species which is likely to become an endangered species within the foreseeable future and which has been designated in the Federal Register as a threatened species.

Total Maximum Daily Load (TMDL): A calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources.

Understory: Low-growing vegetation (herbaceous, brush or reproduction) growing under a stand of trees. Also, that portion of trees in a forest stand below the overstory.

U.S. Fish and Wildlife Service (USFWS): The agency of the Department of the Interior responsible for managing wildlife, including non-ocean going species protected by the Endangered Species Act.

Vehicles Per Day (VPD): The total two-way daily traffic volume on a section of roadway.

Visual quality: Describes the degree of variety in the landscape, created by the basic vegetative patterns, landform, and water forms. Landscapes with the greatest variety or diversity have the greatest potential for high scenic value or visual quality.

Water Rights: The legal right to use water.

Water Supply: A State of Colorado water quality standard (defined as ...waters ...suitable or intended to become suitable for potable water supplies. After receiving standard treatment (defined as coagulation, flocculation, sedimentation, filtration and disinfection with chlorine or its equivalent) these waters will meet Colorado drinking water regulations and any revisions, amendments, or supplements thereto.)

Watershed: The entire area that contributes water to a drainage system or stream.

WCPH: Watershed Conservation Practices Handbook. A Forest Service Region 2 manual suggesting design criteria and guidelines for watershed projects.

WEPP: Water Erosion Prediction Project. A computer erosion model developed by the USDA Agricultural Research service (ARS) in cooperation with the Forest Service to model the physical processes involved in soil erosion mechanics, to produce erosion estimates.

Wilderness: Under the 1964 Wilderness Act, wilderness is undeveloped federal land retaining its primeval character and influence without permanent improvements of human habitation. It is protected and managed so to preserve its natural conditions.

Winter Range: That part of the home range of a species where 90 percent of the individuals are located during the winter at least five out of ten winters.

WIZ (Water Influence Zone): The land next to water bodies where vegetation plays a major role in sustaining long-term integrity of aquatic systems. It includes the geomorphic floodplain (valley bottom), riparian ecosystem, and inner gorge. Its minimum horizontal width (from top of each bank) is 100 feet or the mean height of mature dominant late-seral vegetation, whichever is most.

WRENSS: The Environmental Protection Agency's Handbook *An Approach to Water Resources Evaluation of Non-Point Silvicultural Sources* (WRENSS).

Chapter 8

Index

8. INDEX

B

- Biological Assessment (BA)
 - Chapter 3 52, 66, 86
- Biological Evaluation (BE)
 - Chapter 3 52, 55, 86, 88, 89, 92
- Birds of Prey
 - Chapter 1 2–9
 - Chapter 2 1–5
 - Chapter 3 3–13, 16–23, 28, 29, 32, 33, 36, 39, 40, 45–50, 52, 86, 87, 98, 111

C

- Canada lynx
 - Chapter 1 11, 14
 - Chapter 2 9
 - Chapter 3 21, 52, 53, 54, 63, 67–70, 76, 78, 79
- CDPHE
 - Chapter 1 15
 - Chapter 3 47
- Clean Air Act
 - Chapter 3 40, 43
- Clean Water Act
 - Chapter 1 12
 - Chapter 3 125
- climate change
 - Chapter 3 45
- Colorado River Cutthroat Trout.....
 - Chapter 3 55, 70, 71, 79, 85
- comfortable carrying capacity
 - Chapter 3 3, 7, 8
- Connected Disturbed Area
 - Chapter 1 12
 - Chapter 2 11
 - Chapter 3 111, 112, 116–119, 122, 124
- Council on Environmental Quality
 - Chapter 1 1
 - Chapter 2 1
 - Chapter 3 1
- Critical Habitat
 - Chapter 3 53

cultural resource

- Chapter 1 10
- Chapter 3 131–133

D

- density
 - Chapter 2 9, 10
 - Chapter 3 59–61, 65, 88, 89, 106, 107, 119

E

- elk
 - Chapter 3 63, 64, 75, 76, 83
- Endangered Species Act (ESA)
 - Chapter 1 15
 - Chapter 3 52, 66, 69, 70
- Environmental Protection Agency
 - Chapter 1 8
 - Chapter 3 41
- erosion
 - Chapter 1 12
 - Chapter 2 9–12
 - Chapter 3 26, 76, 77, 79, 100–104, 116, 117, 119, 121

G

- Greenhouse Gas (GHG)
 - Chapter 1 10
 - Chapter 3 45, 46, 47, 49
- groundwater
 - Chapter 1 12
 - Chapter 3 106, 127

I

- in-stream flow
 - Chapter 1 12

M

- Manage-To
 - Chapter 3 3, 4, 7, 8
- Management Indicator Species
 - Chapter 1 10
 - Chapter 3 52, 63–65, 75–77, 83–85

Master Development Plan

- Chapter 12, 4, 6
- Chapter 22
- Chapter 34, 5, 7, 9, 11, 15, 36, 37

mitigation

- Chapter 11, 8, 15
- Chapter 211
- Chapter 330, 40, 75, 113, 114, 119–121, 130

mountain pine beetle (MPB)

- Chapter 13
- Chapter 327, 59, 68, 78, 79, 84–88, 124

N**noxious weeds**

- Chapter 29, 10
- Chapter 388, 93, 94

P**parking**

- Chapter 19, 14
- Chapter 27
- Chapter 36, 12, 13, 17–22, 38

particulate matter

- Chapter 340, 41, 43

project design features (PDF)

- Chapter 18, 15
- Chapter 21, 6, 7–12
- Chapter 311, 30, 71, 72, 74, 76, 77, 84, 85, 94, 95, 98, 103, 118, 120, 121, 124, 131

R**riparian habitat**

- Chapter 112
- Chapter 356

S**Section 106**

- Chapter 3131, 132

sediment

- Chapter 112
- Chapter 210–12
- Chapter 364, 65, 104, 105, 106, 110, 111, 116–118, 121, 122, 126, 130

sensitive species

- Chapter 110, 11
- Chapter 352, 55, 64, 70, 89

Special Use Permit

- Chapter 12, 3, 6, 9, 13
- Chapter 22, 6
- Chapter 33, 4, 7, 11, 23, 24, 27–31, 38, 40, 51, 52, 57–61, 67, 71, 73, 78, 81, 82, 85–87, 91, 93, 94, 97, 98, 103, 122, 125, 129, 132

Species of local concern (SOLC)

- Chapter 29
- Chapter 396

State Historic Preservation Office (SHPO)

- Chapter 3131, 132

stream health

- Chapter 111
- Chapter 211
- Chapter 384, 85, 105, 109, 110, 111, 116, 118, 119, 123, 124, 126

T**threatened species**

- Chapter 110, 11
- Chapter 351–53, 68, 87, 88

U**U.S. Army Corps of Engineers**

- Chapter 3125

U.S. Fish and Wildlife Service

- Chapter 18, 15
- Chapter 352–54, 69, 88, 89

V**Vail Valley Foundation**

- Chapter 334, 37

W**Water Influence Zone**

- Chapter 113
- Chapter 29, 10, 12
- Chapter 377, 84, 85, 105, 110, 111, 117–119, 122, 124, 126

water rights

- Chapter 13
- Chapter 23

water yield	Chapter 3 77, 99, 105, 106, 109–111, 116–120, 122, 126
Chapter 1 12, 13	World Cup
Chapter 3 77, 84, 85, 107, 108, 115, 119, 123, 124	Chapter 1 2, 4, 5, 9, 10, 13
Watershed Conservation Practices (WCP)	Chapter 2 1
Chapter 2 10, 11	Chapter 3 4–13, 16–22, 32–40, 45–51, 1132
Chapter 3 77, 99, 105, 106, 126	
Watershed Conservation Practices Handbook (WCPH)	
Chapter 2 10, 11	

Appendices

APPENDIX A: CUMULATIVE EFFECTS PROJECTS

The following past, present, and reasonably foreseeable future projects have been identified by the Forest Service as relevant for analysis in Alternatives 1 and 2 from a cumulative effects context. Basic information provided here for each project is complimented in corresponding analyses in Chapter 3. Not all resources would be affected by all of these projects. Cumulative effects analyses presented in Chapter 3 resource sections are based on these descriptions and the best available information for each project. Projects are located on National Forest System lands, unless otherwise noted.

**Table A-1:
Cumulative Effects Matrix**

Project (Project Status)	Project Location (Straight Line Distance to BSR SUP)	Project Description	Project Approval/ Implementation	Project Area (acres/length)	Lynx Analysis Unit where the Project is Located	Resources Potentially Affected
BEAVER CREEK PROJECTS						
2011 Summer Improvements	Within Beaver Creek Resort's SUP area	The 2011 summer projects included a snowmaking spur line and hydrant on the Grand Traverse as well as minor grading around the World Cup Storage facility.	Implemented: 2011	--	Eagle Valley	Recreation Scenery Soils Vegetation Watershed Wildlife
Rose Bowl Chairlift Replacement	Within Beaver Creek Resort's SUP area	Replaced the Rose Bowl Lift, Chair 4, with a detachable quad chairlift in the same alignment, but the top terminal is located uphill of the original location. The uphill capacity of the lift increased from 1,689 people per hour (pph) to 2,400 pph.	Implemented 2011	Approximately 6,315 feet.	Eagle Valley	Recreation Scenery Soils Vegetation Watershed Wildlife

**Table A-1:
Cumulative Effects Matrix**

Project (Project Status)	Project Location (Straight Line Distance to BSR SUP)	Project Description	Project Approval/ Implementation	Project Area (acres/length)	Lynx Analysis Unit where the Project is Located	Resources Potentially Affected
2010 Summer Improvements	Within Beaver Creek Resort's SUP area	An outdoor wedding venue was created near Spruce Saddle and a new children's ski trail was constructed from Riperoo's Retreat to Cinch.	Implemented: 2010	Approximately 0.5 acre	Eagle Valley	Recreation Scenery Soils Vegetation Watershed Wildlife
Beaver Creek Forest Health Project	Within Beaver Creek Resort's SUP area	Vegetation treatments on 553 acres affected by Mountain Pine Beetle within the Beaver Creek SUP area.	Approved: 2011	553 acres	Eagle Valley	Recreation Scenery Soils Vegetation Watershed Wildlife
2008 Summer Improvements	Within Beaver Creek Resort's SUP area	Constructed the Polar Plunge gladed skiing area, Buckboard Connector ski trail and the Bachelor Gulch Beginner Route, as well as an Environmental Learning Center at Spruce Saddle.	Implemented: 2008	Approximately 3.3 acres	Eagle Valley	Recreation Scenery Soils Vegetation Watershed Wildlife
Stone Creek Trail Construction	From the golf course to the SUP	Construction of the Stone Creek Access and Egress Trail	Implemented 2006	Approximately 2.5 acres	Eagle Valley	Recreation Scenery Soils Vegetation Watershed Wildlife

**Table A-1:
Cumulative Effects Matrix**

Project (Project Status)	Project Location (Straight Line Distance to BSR SUP)	Project Description	Project Approval/Implementation	Project Area (acres/length)	Lynx Analysis Unit where the Project is Located	Resources Potentially Affected
Vail/Beaver Creek Bug Trees	Within Beaver Creek Resort's and Vail Resort's SUP areas	Treatment of beetle-infested trees within the SUP.	Implemented 2003	Specific trees	Eagle Valley	Recreation Scenery Soils Vegetation Watershed Wildlife
Snowmaking Expansion Beaver Creek Resort	Within Beaver Creek Resort's SUP area	Construction of snowmaking infrastructure on existing ski trails	Implemented 2005	131 acres	Eagle Valley	Recreation Soils Vegetation Watershed
1998 Snowmaking Expansion Beaver Creek Resort	Within Beaver Creek Resort's SUP area	Construction of snowmaking infrastructure on existing ski trails, including: <i>Cinch, Stone Creek Meadows, Harrier, Ptarmigan, Upper Larkspur, Lower Paintbrush, Primrose, Sawbuck, Stacker</i> , as well as on the proposed terrain through Thresher Glades and on the west side of Centennial Express	Approved in 1998, not yet implemented	--	Eagle Valley	Recreation Soils Vegetation Watershed
Beaver Creek Winter Sports Site and Year-round Recreation Area	Within Beaver Creek Resort's SUP area	Authorization of construction of Beaver Creek	1976 - Ongoing	3,849 acres with Beaver Creek's SUP area	Eagle Valley	Recreation Scenery Soils Vegetation Watershed Wildlife